

FINAL

**No Further Remedial Action Planned
Decision Document
Site OT45**



**Wurtsmith Air Force Base
Michigan**

Prepared For

**Air Force Center for Environmental Excellence
Technology Transfer Division
Brooks Air Force Base
San Antonio, Texas**

and

**Wurtsmith Air Force Base
Michigan**

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February 1998

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Air Force Center for Environmental Excellence
Brooks Air Force Base
San Antonio, Texas
and
Wurtsmith Air Force Base
Michigan**

February 1998

Prepared by

**Parsons Engineering Science, Inc.
1700 Broadway, Suite 900
Denver, CO 80290**

TECHNICAL DOCUMENT TO SUPPORT NO FURTHER ACTION DECLARATION

SITE NAME AND LOCATION

Installation Restoration Program Site OT45
Defense Reutilization and Marketing Office
Wurtsmith Air Force Base
Oscoda, Michigan

STATEMENT OF PURPOSE AND BASIS

The purpose of this No Further Remedial Action Planned Decision Document (DD) is to recommend a preferred alternative for remedial action at Site OT45. This recommendation is based on the results of the Installation Restoration Program (IRP) remedial investigation (RI) conducted in 1992 and additional site investigation and sampling conducted between 1994 and 1997.

DESCRIPTION OF THE SELECTED REMEDY

Based on current conditions at Site OT45 on Wurtsmith AFB, it has been determined that existing site conditions do not pose unacceptable risks to human health and the environment. This site documentation recommends no further action because natural chemical attenuation mechanisms have reduced contaminant concentrations in affected media (i.e., soils and groundwater) to levels below Michigan Department of Environmental Quality (MDEQ) commercial/industrial cleanup criteria.

DECLARATION

This Decision Document represents the recommended and selected remedial action for site redevelopment in accordance with Michigan Public Act 451, Part 201. It has been determined that natural attenuation mechanisms have eliminated the risks associated with potential receptor exposure to site-related chemical contamination by reducing contaminant concentrations to levels below those considered to be protective of human health and the environment. The selected remedy will meet Federal and State requirements that are applicable, or relevant and appropriate.

*Paul Rekowski, U.S. Air Force Operating Location-T,
Environmental Coordinator*

Date

Diana Mally, USEPA BCT Member

Date

State of Michigan, BCT Member

Date

REPORT DOCUMENTATION PAGE

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DECISION DOCUMENT DISCLAIMER

This Decision Document has been prepared for the United States Air Force by Parsons Engineering Science, Incorporated for the purpose of implementing a no further remedial action plan under the Air Force Installation Restoration Program (IRP). The objective of this Decision Document is to close Site OT45 and remove the site from the IRP. This decision is based on investigations performed at the site and the investigation results. Copies of this report may be requested from the Air Force Center for Environmental Excellence (AFCEE/ERT) Brooks AFB, TX 78235.

EXECUTIVE SUMMARY

A comprehensive site investigation addressing soils and groundwater contaminated with heating fuel oil hydrocarbon compounds at Installation Restoration Program Site OT45, was conducted at Wurtsmith Air Force Base (AFB), Michigan, by Parsons Engineering Science, Inc. (Parsons ES). The field work was conducted according to the *Final Work Plan for a Remedial Action Plan in Support of the Risk-Based Approach to Remediation at Site* (Parsons ES 1994a). The risk-based demonstration for remediation of Site OT45 is sponsored by the United States (US) Air Force Center for Environmental Excellence (AFCEE) at Brooks AFB, Texas under contract F41624-93-C-8044.

The original intent of the work plan was to complete a remedial action plan (RAP) in support of a risk-based remediation decision for Site OT45. However, due to relatively low contaminant concentrations found in soil and groundwater samples, a decision was made to continue monitoring the site for several years to determine if contaminant levels would naturally decrease. Subsequent soil sampling in 1996 and groundwater sampling in 1996 and 1997 confirm that contaminant levels are now below generic commercial / industrial cleanup criteria. In view of this information a decision was made to present relevant site data in this No Further Remedial Action Planned Decision Document (DD) and apply for site closure.

Previous site investigations include a remedial investigation and feasibility study conducted by ICF in 1992 and 1993, respectively. Initial characterization field efforts for the Parsons ES risk-based investigation were conducted in September and October 1994. Groundwater monitoring data were collected in September 1995, November 1996, and June 1997 to verify the natural biodegradation of site contaminants. Additional soil sampling was completed in July/August 1996. Data presented in this DD focus on the results from 1996 and 1997 soil and groundwater sampling which show the site meets generic commercial/industrial cleanup criteria.

Wurtsmith AFB was officially closed as a military facility on June 30, 1993. Site OT45 is located in the northern portion of the former Base adjacent to Building 5608, within the confines of the former Defense Reutilization and Marketing Office (DRMO) storage facility. The site is located within a remote area of the Base, and consists of four storage buildings, an abandoned office building, and covered and uncovered staging areas. A former underground storage tank (UST) located on the northern side of Building 5608 is suspected of having leaked heating fuel oil when it failed tank integrity testing in the fall of 1991. The tank was purged in October 1991, and it remained empty until its removal in May 1992 (ICF Technology, Inc., 1993).

It is the intent of the Air Force to demonstrate in this DD attainment of MDEQ (1995b) nonsite-specific, land use-based (i.e., generic) industrial and commercial subcategory IV cleanup criteria at Site OT45. The activities conducted to meet this objective include characterizing:

- The nature and extent of fuel hydrocarbon contamination at the site;

- The local geology, hydrogeology, and hydrology that may affect contaminant transport;
- The proximity of the site to drinking water aquifers, surface water bodies, and other sensitive environmental resources, and;
- Comparing soil and groundwater sampling results to generic residential and commercial/industrial cleanup criteria

The current and foreseeable land use scenarios at Site OT45 are both industrial and commercial. The site is currently abandoned, except for occasional environmental restoration personnel. The current land use thus can be classified as industrial in nature. The reuse plan for Wurtsmith AFB designates the land at Site OT45 to be used for convention/tourist services (US Air Force, 1993). Any construction activities undertaken pursuant to future land use scenarios will be industrial or commercial in nature. The nature of planned activities at the potential convention/tourist facility are representative of the types of activities outlined by MDEQ (1995b) for commercial subcategory IV sites. Consequently, the current and future land use at Site OT45 will be first industrial and, possibly, commercial in nature. Hypothetical current receptors include non-intrusive and intrusive industrial workers. Hypothetical future onsite receptors could include visitors to the planned convention center and any office personnel.

The 1996 compliance soil sampling effort included collecting several soil samples to confirm that contaminants have been attenuated to a point where the concentrations are below generic soil leaching criteria. This 1996 sampling event indicated that no concentrations of site contaminants in soil currently exceed the most stringent of the MDEQ (1995a) generic residential criteria.

Concentrations of dissolved fuel-related contaminants in the groundwater underlying Site OT45 have been observed to decrease via naturally occurring chemical attenuation mechanisms, and have remained at concentrations that are protective of current and future onsite receptors. Historical data collected from 1992 through 1997 confirm reductions in contaminant concentrations and minimal forward migration in groundwater. Based on 1996 and 1997 sampling, the site groundwater meets MDEQ (1995a) generic residential cleanup criteria for groundwater except for one compound in one well. The one exception is the level of 1,2,4-Trimethylbenzene in MW-2, which exceeds residential criteria but is below commercial / industrial cleanup criteria. Verification soil sampling indicates that soil contaminants are not present at concentrations sufficient to impact groundwater and elevate onsite dissolved contaminant concentrations to levels that exceed MDEQ (1995b) generic commercial / industrial groundwater cleanup criteria.

In summary, site analytical data indicate that soils meet the most restrictive (residential) generic cleanup criteria and groundwater also meets residential criteria except for one compound in one monitoring well. Because of this single elevated result, site closure under commercial/industrial criteria is proposed. This DD proposes that no additional remediation is necessary to achieve appropriate generic cleanup criteria and to protect onsite and offsite receptors, and that the site may be eligible for closure with land use restricted to commercial/industrial uses.

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SECTION 1

INTRODUCTION

1.1 PURPOSE AND SCOPE

Parsons Engineering Science, Inc. (Parsons ES) was retained by the United States (US) Air Force Center for Environmental Excellence (AFCEE) to complete a risk-based site closure demonstration at Site OT45 at Wurtsmith Air Force Base (AFB), Michigan. This work is culminating with the preparation of a No Further Remedial Action Planned Decision Document (DD) for soil and groundwater contaminated with heating fuel oil hydrocarbons for the site. The Base was formally closed as a military facility on June 30, 1993. A historical release from a former underground storage tank (UST) at a former Defense Reutilization and Marketing Office (DRMO) located near the northern boundary of Wurtsmith AFB is suspected as having contaminated the surrounding subsurface with heating fuel oil hydrocarbons. The UST had been used to store heating fuel oil to support the heating requirements of the DRMO.

This DD demonstrates that site-related contaminant concentrations at IRP Site OT45 meet generic health-based residential cleanup criteria (MDEQ, 1995b) at all monitoring locations except for one. At MW-11, the level of 1,2,4-Trimethylbenzene exceeds residential criteria, but does not exceed commercial / industrial criteria.

1.2 REPORT ORGANIZATION

This DD consists of five sections, including this introduction, and six appendices. Site background, including operational history and a review of environmental site investigations conducted to date, are provided in the remainder of this section. Section 2 summarizes the topographic, geologic, hydrogeologic and climatic setting of the site. Section 3 includes results of soil gas, soil and groundwater sampling and section 4 contains a data summary and analysis. Section 5 includes a request for an MDEQ-approved conditional closure of Site OT45 under generic commercial / industrial cleanup standards. References are found in Section 7.

Appendix A contains boring logs, well construction diagrams, and well development data for activities completed in 1994. Appendix B contains seventeen tables of soil and groundwater analytical data, geochemical field data, quality control/data validation information and other laboratory results.

1.3 SITE BACKGROUND

1.3.1 Location and Description

Wurtsmith AFB is located approximately 2 miles west of Oscoda, Michigan, within Iosco County (Figure 1.1). The Base is bounded on the north by Van Etten Lake, on the south by the Au Sable River and the Huron National Forest, on the east and the southeast by the cities of Oscoda and Au Sable, respectively, and on the west by the Alpena State Forest. The Base is less than 1 mile west of the western shore of Lake Huron. Van Etten Lake is a manmade lake that is surrounded by recreational cottages and local residential communities. The cities of Oscoda and Au Sable have a combined population of about 11,000 people [ICF Technology, Inc. (ICF), 1993 and 1994]. Wurtsmith AFB was placed on the 1991 Department of Defense Base Closure and Realignment Commission's list for closure. The Base was officially closed on June 30, 1993.

Site OT45 is located in the northern portion of the Base (Figure 1.2), and is the site of a former 1,000-gallon heating fuel oil underground storage tank (UST). The UST was located adjacent to Building 5608 in the DRMO complex. After the heating oil UST failed a Tracer Tight™ tank test, it was purged in October 1991, and remained empty until removed in May 1992 (ICF, 1993).

1.3.2 Previous Remedial Investigations

A series of remedial investigations were conducted prior to the confirmation soil and groundwater sampling events performed in 1996 and 1997 (Figure 1.3). Two groundwater monitoring wells (W-OT45 and E-OT45) were installed at the ends of the former UST location in 1992 when the UST was removed. Composite soil samples were collected during this effort, and analyzed for benzene, toluene, ethylbenzene, and total xylenes (BTEX) and polynuclear aromatic hydrocarbon (PAH) compounds. Analytical results are contained in reports issued by ICF in 1993 and 1994 (ICF, 1993 and 1994).

Site OT45 was also partially characterized during a 1992 remedial investigation (RI) and a 1993 draft feasibility study (FS) under the Air Force IRP by ICF (1993 and 1994). As part of the RI, seven soil boreholes were drilled to depths up to 13 feet (ft) below ground surface (bgs) and sampled for BTEX, PAHs, methyl butyl ether (MTBE), and lead. Site-related contaminants were detected only in soil samples collected from the interval immediately above the water table (smear zone) during the 1992 RI.

Three of the seven RI boreholes were completed as groundwater monitoring wells (MW-1, MW-2, and MW-3). Groundwater samples were collected from the five existing monitoring wells during the RI (ICF, 1993). All collected samples were analyzed for BTEX, MTBE, and PAHs.

1.3.2.1 1994 Risk-Based Investigation Activities

The investigation completed at Site OT45 under the initial 1994 risk-based remediation field test was conducted using the approach and methodologies presented

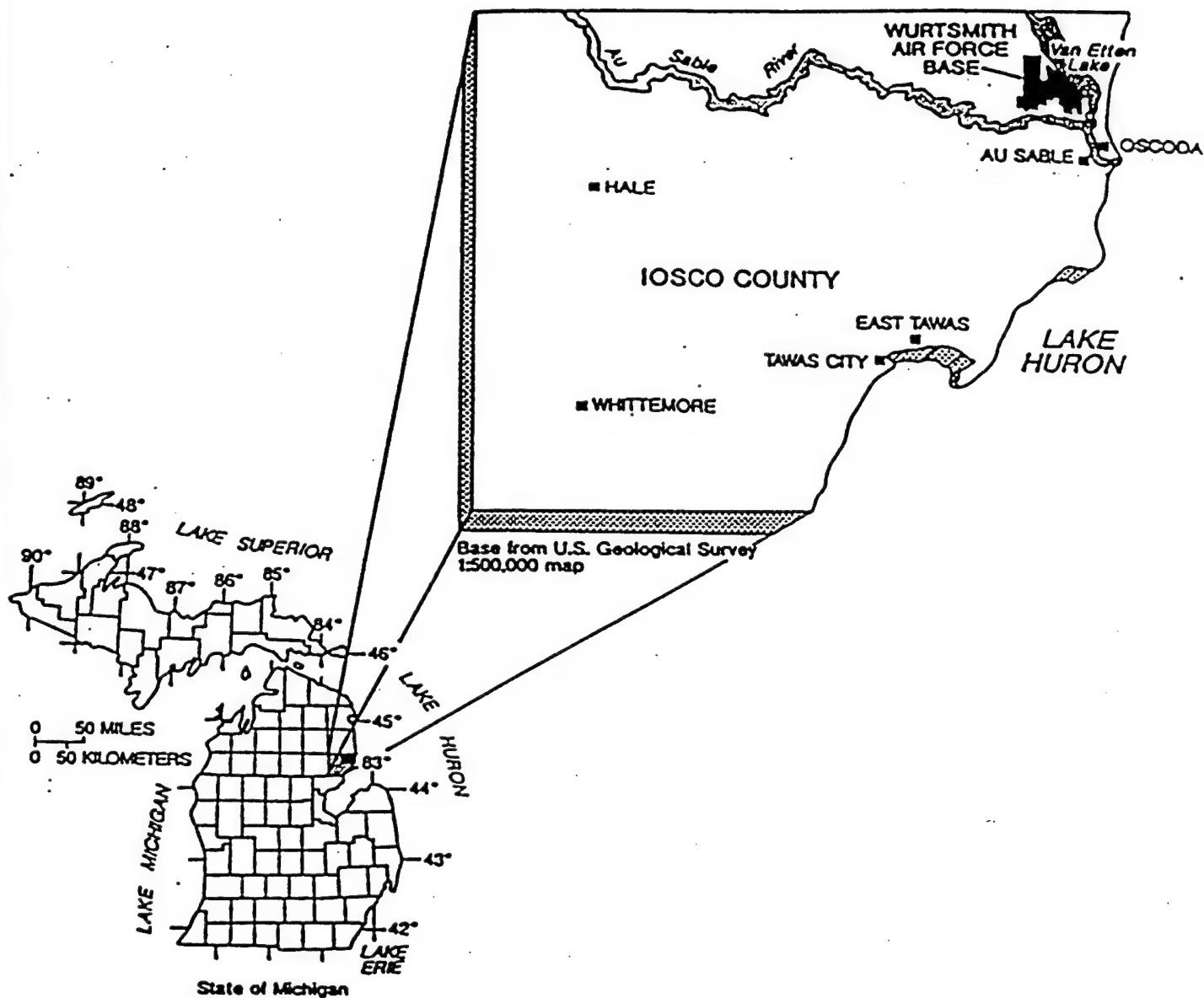


FIGURE 1.1

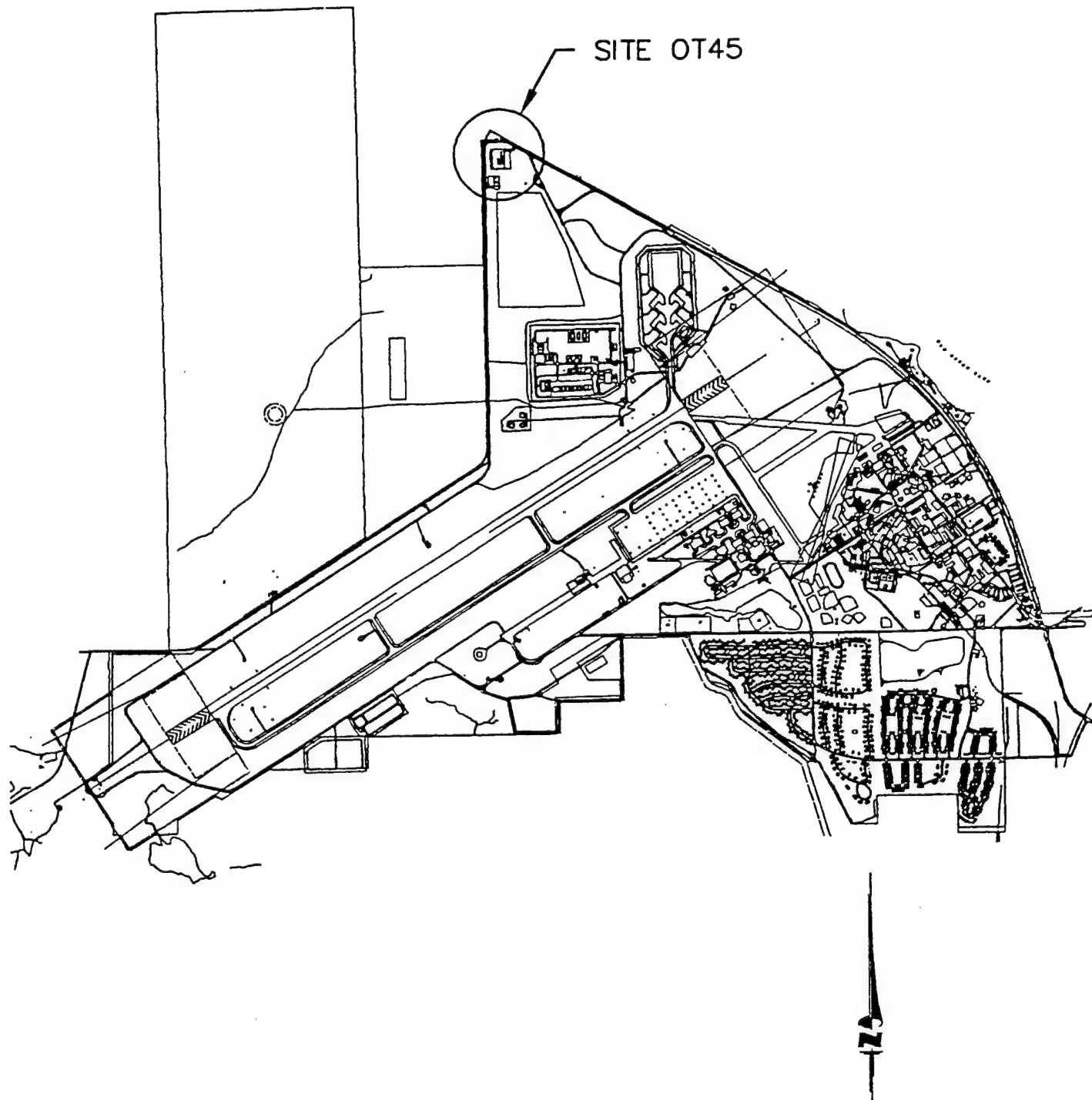
REGIONAL MAP

Remedial Action Plan
Risk-Based Approach to Remediation
Site OT45
Wurtsmith AFB, Michigan



**PARSONS
ENGINEERING SCIENCE, INC.**

Denver, Colorado



Not to Scale

FIGURE 1.2

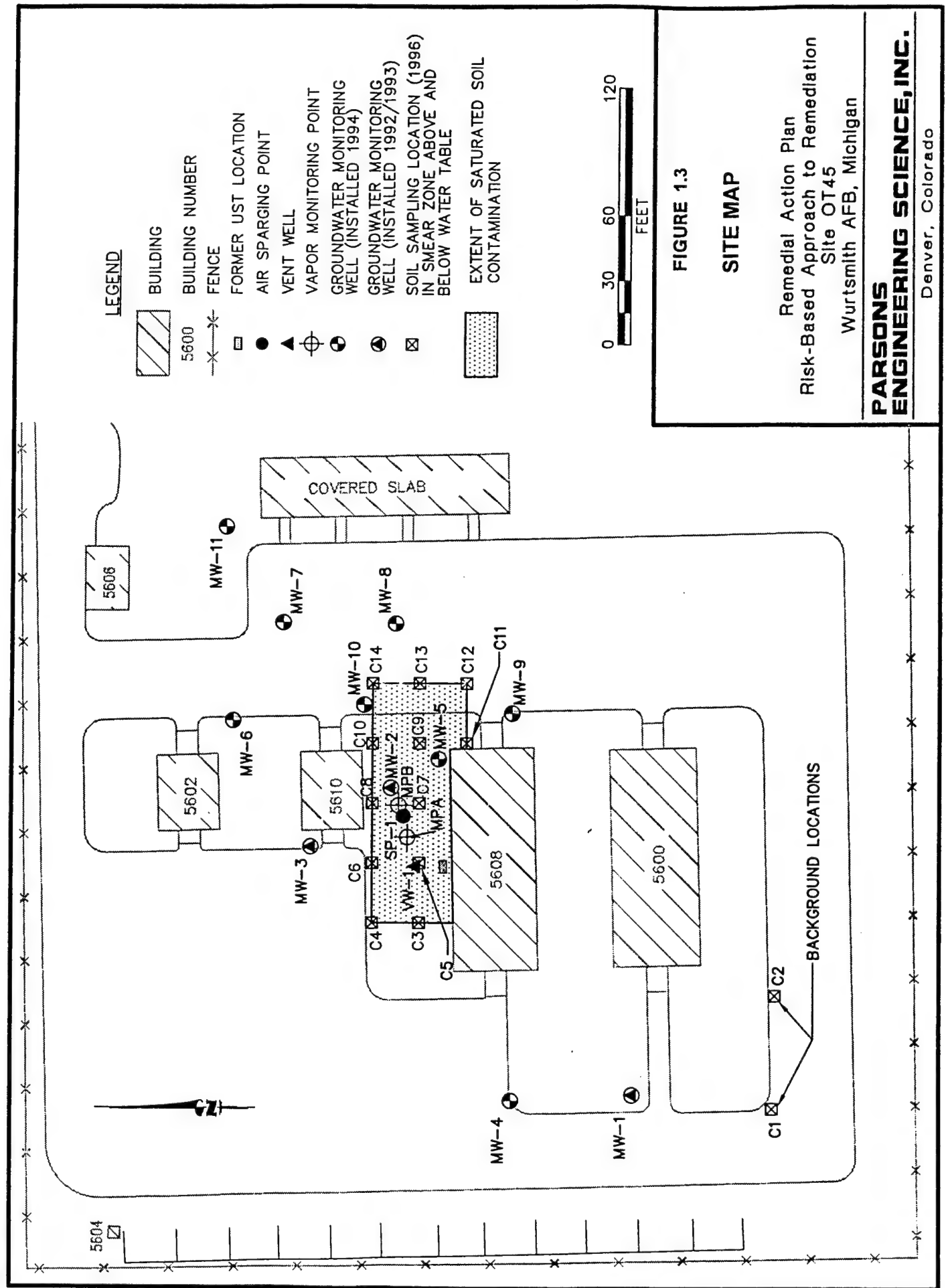
**LOCATION OF SITE OT45
WITHIN WURTSMITH AFB**

Remedial Action Plan
Risk-Based Approach to Remediation
Site OT45
Wurtsmith AFB, Michigan



**PARSONS
ENGINEERING SCIENCE, INC.**

Denver, Colorado



in the *Work Plan for a Remedial Action Plan in Support of the Risk-Based Approach to Remediation at Site OT45* (Parsons ES, 1994a) (hereinafter referred to as the work plan). The following planned sampling and testing activities were performed by Parsons ES at Site OT45 as part of this field test:

- Collection of soil gas samples at 3 locations ;
- Collection of soil gas flux samples at 4 locations, including a background location;
- Drilling and installation of 8 permanent groundwater monitoring wells, 2 soil gas (vapor) monitoring points, 1 air injection bioventing test well, and 1 biosparging point;
- Collection of 3 surface soil and 14 discrete subsurface soil samples from 12 new soil boreholes for field screening and fixed-base analytical evaluation;
- Collection of 14 groundwater samples from different sampling locations for field and/or fixed-base analytical evaluation;
- Aquifer slug testing at 5 sampling locations, MW-4, MW-7, MW-10, MW-11, and MPA;
- Completion of an air permeability test and an oxygen influence test to assess the effectiveness of bioventing technology at stimulating natural biodegradation of heating oil hydrocarbons in unsaturated soil; and
- Completion of initial testing at the biosparging point to define optimum operational parameters in the event that a full-scale biosparging system is required to promote rapid natural biodegradation of heating oil hydrocarbons in saturated soils and shallow groundwater.

1.3.2.2 1995 Groundwater Monitoring Activities

In addition to the 1994 risk-based investigation, groundwater sampling was performed at select wells as part of a limited groundwater monitoring program sponsored by AFCEE to document reductions in concentration and extent of migration of site-related contamination over time. After evaluating the 1994 risk-based investigation results, seven groundwater monitoring wells and one monitoring point [MW-2, MW-4, MW-5, MW-7, MW-10, MW-11, MPB, and VW-1 (W-OT45)] were selected to monitor potential contaminant migration over time. Groundwater was collected from these sampling locations in September 1995 for fixed-based analytical analysis and field screening tests.

1.3.2.3 1996/1997 Groundwater Monitoring Activities

In an effort to verify predictions of reduction in the concentrations and migration of the site-related contamination over time, limited groundwater sampling was completed in November 1996 [MW-2 and MW-7], June 1997 [MW-2, MW-5, and VW-1], and

November 1997 [MW-2 and MW-11]. Groundwater was collected from these sampling locations for fixed-based analytical analysis.

1.3.2.4 1996 Soil Sampling Activities

In addition to the 1994 risk-based investigation, extensive soil sampling was performed as part of a confirmation sampling plan sponsored by AFCEE to document reductions in concentration and extent of site-related contamination over time. Soil sample locations were selected based on the results of the 1995 risk-based evaluation. Soil samples were collected from these sampling locations in July/August 1996 for fixed-based analytical analysis.

1.3.2.5 Summary of Sampling Methodology

A descriptive summary of all of the field and fixed-base analytical methods used at Site OT45 is presented in Table 1.1. All analytical methods and their program-specific method detection limits (MDLs) are identical to those recommended by MDEQ (1994b) in Operational Memorandum #6, Revision 3. Further details on analytical methods and data validation procedures are presented in Appendix B. Table 1.2 summarizes the field and fixed-base analytical methods used at each sampling location. Field sampling and testing activities are summarized briefly in the following sections.

TABLE 1.1
ANALYTE REPORTING LIMITS
NO FURTHER REMEDIAL ACTION PLANNED DECISION DOCUMENT
SITE 0145, WURSMITH AFB, MICHIGAN

| Compound | Analytical Method | Field or Fixed-Base | Soil Gas MDL | Soil Gas Units | Site-Specific Soil MDL | MDNR Soil Required MDL | Soil Reporting Limit | Soil Units | Site-Specific Water MDL | MDNR Water Required MDL | Water Reporting Limit | Water Units |
|--------------------------------|-------------------|---------------------|--------------|----------------|------------------------|------------------------|----------------------|------------|-------------------------|-------------------------|-----------------------|-------------|
| Benzene | TO3 | Fixed-Base | 0.006 | mg/L | | | | | | | | |
| Toluene | TO3 | Fixed-Base | 0.008 | mg/L | | | | | | | | |
| Ethylbenzene | TO3 | Fixed-Base | 0.009 | mg/L | | | | | | | | |
| Xylene (Total) | TO3 | Fixed-Base | 0.009 | mg/L | | | | | | | | |
| Petroleum Hydrocarbons | TO3 | Fixed-Base | 0.130 | mg/L | | | | | | | | |
| Total Extractable Hydrocarbons | M8015 | Fixed-Base | | | | | | | 0.522 | | 5.000 | µg/L |
| Total Volatile Hydrocarbons | M8015 | Fixed-Base | | | 5.840 | | 110.000 | µg/kg | 0.089 | | 1.000 | µg/L |
| Benzene | SW8020 | Fixed-Base | | | 0.400 | 10.000 | | µg/kg | 0.283 | 1.000 | 0.400 | µg/L |
| Toluene | SW8020 | Fixed-Base | | | 0.400 | 10.000 | | µg/kg | 0.257 | 1.000 | 4.000 | µg/L |
| Ethylbenzene | SW8020 | Fixed-Base | | | 0.400 | 10.000 | | µg/kg | 0.283 | 1.000 | 4.000 | µg/L |
| Xylene (Total) | SW8020 | Fixed-Base | | | 0.400 | 30.000 | | µg/kg | 0.247 | 3.000 | 4.000 | µg/L |
| 1,2,3-Trimethylbenzene | SW8020 | Fixed-Base | | | 0.400 | | | µg/kg | 0.153 | 1.000 | 4.000 | µg/L |
| 1,2,4-Trimethylbenzene | SW8020 | Fixed-Base | | | 0.400 | 10.000 | | µg/kg | 0.168 | | 4.000 | µg/L |
| 1,3,5-Trimethylbenzene | SW8020 | Fixed-Base | | | 0.400 | | | µg/kg | 0.168 | | 4.000 | µg/L |
| 2-Methylnaphthalene | SW8270 | Fixed-Base | | | 10.000 | 330.000 | 330.000 | µg/kg | 0.010 | 5.000 | 10.000 | µg/L |
| Acenaphthene | SW8270 | Fixed-Base | | | 10.000 | 330.000 | 330.000 | µg/kg | 0.430 | 5.000 | 10.000 | µg/L |
| Acenaphthylene | SW8270 | Fixed-Base | | | 10.000 | 330.000 | 330.000 | µg/kg | 0.270 | 5.000 | 10.000 | µg/L |
| Anthracene | SW8270 | Fixed-Base | | | 10.000 | 330.000 | 330.000 | µg/kg | 0.320 | 5.000 | 10.000 | µg/L |
| Benzo(a)anthracene | SW8270 | Fixed-Base | | | 10.000 | 330.000 | 330.000 | µg/kg | 0.350 | 5.000 | 10.000 | µg/L |
| Benzo(b)pyrene | SW8270 | Fixed-Base | | | 10.000 | 330.000 | 330.000 | µg/kg | 0.370 | 5.000 | 10.000 | µg/L |
| Benzo(k)fluoranthene | SW8270 | Fixed-Base | | | 10.000 | 330.000 | 330.000 | µg/kg | 0.440 | 5.000 | 10.000 | µg/L |
| Benzo(e)pyrene | SW8270 | Fixed-Base | | | 10.000 | 330.000 | 330.000 | µg/kg | 0.200 | 5.000 | 10.000 | µg/L |
| Benzo(g,h,i)perylene | SW8270 | Fixed-Base | | | 10.000 | 330.000 | 330.000 | µg/kg | 0.510 | 5.000 | 10.000 | µg/L |
| Chrysene | SW8270 | Fixed-Base | | | 10.000 | 330.000 | 330.000 | µg/kg | 0.330 | 5.000 | 10.000 | µg/L |
| Dibenz(a,h)anthracene | SW8270 | Fixed-Base | | | 10.000 | 330.000 | 330.000 | µg/kg | 0.680 | 5.000 | 10.000 | µg/L |
| Dibenzofuran | SW8270 | Fixed-Base | | | 10.000 | 330.000 | 330.000 | µg/kg | 0.010 | 5.000 | 10.000 | µg/L |
| Fluoranthene | SW8270 | Fixed-Base | | | 10.000 | 330.000 | 330.000 | µg/kg | 0.410 | 5.000 | 10.000 | µg/L |
| Fluorene | SW8270 | Fixed-Base | | | 10.000 | 330.000 | 330.000 | µg/kg | 0.420 | 5.000 | 10.000 | µg/L |
| Indeno(1,2,3-cd)pyrene | SW8270 | Fixed-Base | | | 10.000 | 330.000 | 330.000 | µg/kg | 0.470 | 5.000 | 10.000 | µg/L |
| Naphthalene | SW8270 | Fixed-Base | | | 10.000 | 330.000 | 330.000 | µg/kg | 0.380 | 5.000 | 10.000 | µg/L |
| Phenanthrene | SW8270 | Fixed-Base | | | 10.000 | 330.000 | 330.000 | µg/kg | 0.190 | 5.000 | 10.000 | µg/L |

TABLE 1.1 (Continued)
ANALYTE REPORTING LIMITS
NO FURTHER REMEDIAL ACTION PLANNED DECISION DOCUMENT
SITE 0T45, WURSMITH AFB, MICHIGAN

| Compound | Analytical Method | Field or Fixed-Base | Soil Gas MDL | Soil Gas Units | Site-Specific Soil MDL | MDNR Soil Required MDL ^a | Soil Reporting Limit | Soil Units | Site-Specific Water MDL | MDNR Water Required MDL ^a | Water Reporting Limit | Water Units |
|---|-------------------|---------------------|--------------|----------------|------------------------|-------------------------------------|----------------------|------------|-------------------------|--------------------------------------|-----------------------|-------------|
| Pyrene | SW8270 | Fixed-Base | | | 10,000 | 330,000 | 330,000 | µg/kg | 0.370 | 5,000 | 10,000 | µg/L |
| pH | SW9045 | Fixed-Base | | | | | 0.010 | pH Units | | | | |
| Total Organic Carbon | SW9060 | Fixed-Base | | | 0.015 | | 0.050 | Percent | | | | |
| Moisture, Percent | E160.3 | Fixed-Base | | | | | 0.100 | Percent | | | | |
| Phosphorus, Total Orthophosphate (as P) | E300.0 | Fixed-Base | | | 0.510 | | 2,500 | mg/kg | | | | |
| Alkalinity, Total (as CaCO ₃) | E310.1 | Fixed-Base | | | | | 25,000 | mg/kg | | | | |
| Nitrogen, Total Kjeldahl | E351.3 | Fixed-Base | | | 5,000 | | 5,000 | mg/kg | | | | |
| Iron | SW6010 | Fixed-Base | | | 0.032 | 2,000 | 1,600 | mg/kg | | | | |
| Benzene | SW8240 | Fixed-Base | | | | | | | 0.330 | 1,000 | 0.400 | µg/L |
| Toluene | SW8240 | Fixed-Base | | | | | | | 0.380 | 1,000 | 5,000 | µg/L |
| Ethylbenzene | SW8240 | Fixed-Base | | | | | | | 0.450 | 1,000 | 5,000 | µg/L |
| Xylene (Total) | SW8240 | Fixed-Base | | | | | | | 0.220 | 3,000 | 5,000 | µg/L |
| 1,2,3-Trimethylbenzene | SW8240 | Fixed-Base | | | | | | | 0.200 | 1,000 | 5,000 | µg/L |
| 1,2,4-Trimethylbenzene | SW8240 | Fixed-Base | | | | | | | 0.200 | 5,000 | 5,000 | µg/L |
| 1,3,5-Trimethylbenzene | SW8240 | Fixed-Base | | | | | | | 0.200 | 5,000 | 5,000 | µg/L |
| Benzene | SW8260 | Fixed-Base | | | | | | | 0.500 | 1,000 | 5,000 | µg/L |
| Toluene | SW8260 | Fixed-Base | | | | | | | 0.500 | 1,000 | 5,000 | µg/L |
| Ethylbenzene | SW8260 | Fixed-Base | | | | | | | 0.500 | 1,000 | 5,000 | µg/L |
| Xylene (Total) | SW8260 | Fixed-Base | | | | | | | 0.500 | 3,000 | 5,000 | µg/L |
| 1,2,3-Trimethylbenzene | SW8260 | Fixed-Base | | | | | | | 0.500 | 1,000 | 5,000 | µg/L |
| 1,2,4-Trimethylbenzene | SW8260 | Fixed-Base | | | | | | | 0.500 | 5,000 | 5,000 | µg/L |
| 1,3,5-Trimethylbenzene | SW8260 | Fixed-Base | | | | | | | 0.500 | 5,000 | 5,000 | µg/L |
| Electrical Conductivity | COND | Field | | | | | | | | | 0.020 | mmhos/cm |
| Dissolved Oxygen | FDO | Field | | | | | | | | | 0.500 | mg/L |
| pH | FPH | Field | | | | | | | | | 0.000 | pH Units |
| Redox Potential | FREDOX | Field | | | | | | | | | 0.000 | pE Units |
| Temperature | FTEMP | Field | | | | | | | | | 1.000 | ° C |
| Iron | H8008 | Field | | | | | | | 0.010 | 0.100 | 0.024 | mg/L |
| Nitrate | H8039 | Field | | | | | | | 0.010 | | 0.066 | mg/L |
| Nitrite | H8040 | Field | | | | | | | 0.005 | | 0.010 | mg/L |
| Sulfate | H8051 | Field | | | | | | | 0.010 | | 0.010 | mg/L |
| Hydrogen Sulfide | H8131 | Field | | | | | | | 0.010 | 0.200 | 0.024 | mg/L |
| Iron, Ferrous | H8146 | Field | | | | | | | 0.010 | | 0.024 | mg/L |
| Alkalinity, Total (as CaCO ₃) | H8221 | Field | | | | | | | | | 20,000 | mg/L |
| Carbon Dioxide | H8223 | Field | | | | | | | 0.010 | | 1,250 | mg/L |
| Manganese | HMANG | Field | | | | | | | 0.010 | 0.020 | 0.050 | mg/L |
| Carbon Dioxide | COU-O2 | Fixed-Base | | | | | | | 4.000 | | 5,000 | mg/L |
| Methane | RSK175 | Fixed-Base | | | | | | | 0.004 | | 0.004 | mg/L |

^a Source: MDNR (1994a) Interoffice Communication Memorandum #6, Revision 3, Analytical Detection Limit Guidance (dated February 4, 1994).

TABLE 1.2
SITE OT45 ANALYSIS SUMMARY
NO FURTHER REMEDIAL ACTION PLANNED DECISION DOCUMENT
SITE OT45, WURTSMITH AFB, MICHIGAN

| SAMPLING LOCATION | NORTHING | EASTING | SAMPLE MATRIX | SAMPLE DEPTH (ft. bgs) | SCREENED ANALYTES AND FIELD PARAMETERS | | | | | | | | | | | SOIL pH | SOIL TOC | |
|--------------------|-----------|------------|----------------|------------------------|--|-----|---------|--------------------|------------------|------|-----|-----|-----|----------|------|---------|----------|---|
| | | | | | BTEX | PNA | TVH/TEH | ELECTRON ACCEPTORS | MOISTURE CONTENT | PHOS | ALK | CO2 | CH4 | NITROGEN | IRON | | | |
| BKG | -- | -- | Soil Gas Flux | NA | 1 ^a | | | | | | | | | | | | | |
| NPA | 423602.29 | 2246385.61 | Soil | 0-25 | | X | | | | | | | | | | | | |
| MPB ^o | 423606.49 | 2246400.48 | Soil Gas | 9-9.5 | 1 | | | | | X | | | | | | X | | |
| | | | Soil Gas Flux | NA | 1 | | | | | | | | | | | | | |
| | | | Soil | 0-25 | | X | | | | | | | | | | | | |
| | | | | 8-9.5 | 2 | X | X | | | X | X | | | X | | | | |
| MW1 | 423496.87 | 2246264.70 | Ground Water | NA | 2 | X | | X | | | | | | | | | | |
| MW2 ^{o/w} | 423610.18 | 2246408.92 | Ground Water | NA | 2 | X | X | | X | | | X | X | | | | | |
| MW3 | 423647.43 | 2246381.06 | Soil Gas | 5-10 | 1 | | | | | | | | | | | | | |
| | | | Soil Gas Flux | NA | 1 | | | | | | | | | | | | | |
| | | | Ground Water | NA | 2 | X | X | | | | | | | | | | | |
| MW4 ^o | 423553.65 | 2246261.74 | Drill Cuttings | 12-15 | 2 | X | X | | | | | X | X | | | | | |
| MW5 ^{o/w} | 423587.70 | 2246422.21 | Ground Water | NA | 2 | X | | | X | | | | | | X | | X | |
| | | | Soil | 10-13 | 2 | X | | | | | | | | | | | | |
| MW6 | 423684.09 | 2246440.02 | Ground Water | NA | 2 | X | | | X | | | | | | | | | |
| | | | Soil | 8-9.5 | 2 | X | | | | | | | | | | | | X |
| MW7 ^{o/w} | 423660.84 | 2246486.03 | Ground Water | NA | 2 | X | | | X | | | | | | | | | |
| | | | Soil | 8-9 | 2 | X | X | | | | | | | | | | | |
| MW8 | 423608.05 | 2246485.58 | Ground Water | NA | 2 | X | X | | X | | | | X | X | | | X | |
| | | | Soil | 8-9.5 | 2 | X | | | | | | | | | | | | |
| MW9 | 423553.39 | 2246443.59 | Ground Water | NA | 2 | X | | | X | | | | | | | | | |
| | | | Soil | 8-9.5 | 2 | X | | | | | | | | | | | | |
| MW10 ^o | 423622.64 | 2246447.63 | Ground Water | NA | 2 | | | | X | | | | | | | | | |
| | | | Soil | 68-70 | | | | | | | X | | | | | | X | X |
| MW11 ^o | 423687.81 | 2246530.32 | Ground Water | NA | 2 | X | | | X | | | | | | | | | |
| | | | Soil | 10-12 | 2 | X | | | | | | | | | | | | |
| | | | | 12-14 | | | | | | | | | | | | | | X |
| VW1 ^{o/w} | 423598.95 | 2246371.88 | Ground Water | NA | 2 & 3 ^o | | | | X | | | | | | | | | |
| | | | Soil Gas | 5-10 | 1 | | | | | | | | | | | | | |
| | | | Soil Gas Flux | NA | 1 | | | | | | | | | | | | | |
| | | | Soil | 0-25 | | X | | | | | | | | | | | | |
| | | | | 8-9.5 | 2 | X | | | X | X | X | | | | X | X | X | |
| | | | Ground Water | NA | 2 | | X | | | | | | | | | | | |

^a 1 = TO3: Determination of Volatile Organic Compounds in Ambient Air

^b 2 = SW8020: Purgeable Aromatics

^c This well was sampled during both the 1994 and 1995 sampling events. Only groundwater samples were collected during the 1995 sampling event. Groundwater samples collected during the 1995 sampling event were analyzed for BTEX, PAHs, and electron acceptors.

^d This well was sampled for purgeable organics (SW8020) in 1996

^e This well was sampled for purgeable organics (SW8020) in 1997.

Note: Soil samples collected in 1996 were analyzed for purgeable organics (SW8020) and PNAs (SW8270).

SECTION 2

PHYSICAL SETTING

This section describes the physical characteristics of Site OT45 as determined from data collected during previous investigations conducted under the IRP and by Parsons ES as part of the 1994 risk-based investigation. Data incorporated into this section from previous investigations were taken from the RI (ICF, 1993) and the FS (ICF, 1994) reports for Site OT45. A summary of site characterization activities completed by Parsons ES to supplement existing data is presented in Section 2 of this DD.

2.1 REGIONAL TOPOGRAPHY AND SURFACE WATER HYDROGEOLOGY

Wurtsmith AFB lies on the relatively flat Oscoda Lake plain physiographic district near the eastern shore of Michigan [US Geological Survey (USGS), 1990]. This plain extends approximately 5 miles from the shore of Lake Huron to 80-foot-high bluffs west of the Base. Elevations in this area range from approximately 580 feet above mean sea level (msl) at Lake Huron to 650 feet above msl near the base of the bluffs. The Base and surrounding area have relatively flat topography, with the northern portion of the Base, including Site OT45, sloping very gently to the northeast toward Van Etten Lake. Surface elevations in the vicinity of Site OT45 range from approximately 617 feet above msl at Site OT45 to 588 feet above msl at Van Etten Lake. The topography and major surface water features of the environs near Wurtsmith AFB are shown on Figure 2.1.

The main surface water bodies in the vicinity of Wurtsmith AFB are Dry Creek, Van Etten Lake, Lake Huron, and the Au Sable River. Dry Creek drains a swampy area located west of the Base and flows into Van Etten Lake. Van Etten Lake is fed by the Pine River from the north, and discharges into Van Etten Creek, located at the southeastern end of the lake. Van Etten Creek is a tributary to the Au Sable River, which drains a large area of Michigan west of the Base and discharges into Lake Huron.

There are no major surface water features on Wurtsmith AFB. Because the topography is relatively flat and the soils beneath the Base are sandy, most precipitation infiltrates into the groundwater system. Runoff from paved areas is collected via a storm sewer system, treated at the Wurtsmith AFB sewage treatment plant, and then discharged into settling ponds located near the southern Base boundary (ICF, 1994). Limited amounts of surface water runoff drain northeast into Van Etten Lake and south into the Au Sable River.

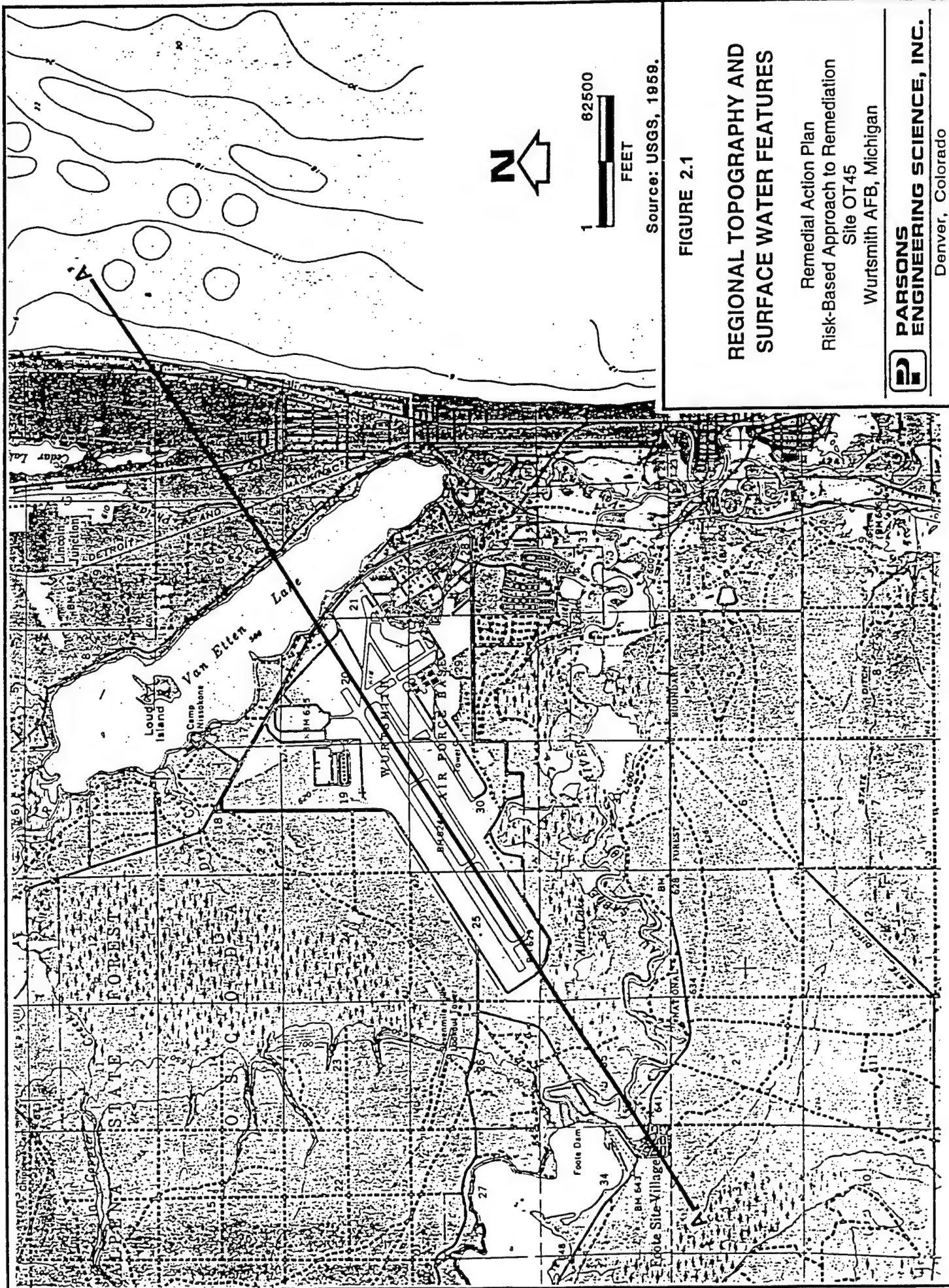


FIGURE 2.1

REGIONAL TOPOGRAPHY AND SURFACE WATER FEATURES

Remedial Action Plan
Risk-Based Approach to Remediation
Site OT45
Wurtsmith AFB, Michigan



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2.2 REGIONAL GEOLOGY AND HYDROGEOLOGY

2.2.1 Geology

The regional geology consists of approximately 100 to more than 250 feet of unconsolidated glacial, deltaic, and lacustrine deposits overlying the Mississippian-aged Marshall Formation sandstone and Coldwater Shale bedrock (Rama Rao and Alfred, Inc., 1992). A generalized geologic cross section of the Base and adjacent area is presented in Figure 2.2. The location of the cross section A-A' is shown on Figure 2.1. The glacially eroded bedrock surface dips gently from west to east toward Lake Huron, and is overlain by unconsolidated Pleistocene and younger deposits. The unconsolidated deposits, progressing upward from the upper bedrock surface, consist of glacial till; lacustrine silt and clay; and beach, eolian, and alluvial sand and gravel deposits.

Glacial till, consisting of clay-rich silt, sand, and gravel, directly overlies the eroded bedrock surface. Above the glacial till is a continuous layer of silty clay lake sediments ranging in thickness from approximately 95 to more than 200 feet. This silty clay layer forms the lower confining layer for the regional, shallow sand and gravel aquifer. The shallowest deposits, extending from the surface to depths of approximately 30 to 80 feet bgs, consist of fine to very coarse sand with occasional gravelly layers. This interval of alluvial, beach, and eolian deposits forms the regional shallow groundwater aquifer, and is the interval of primary interest for this study.

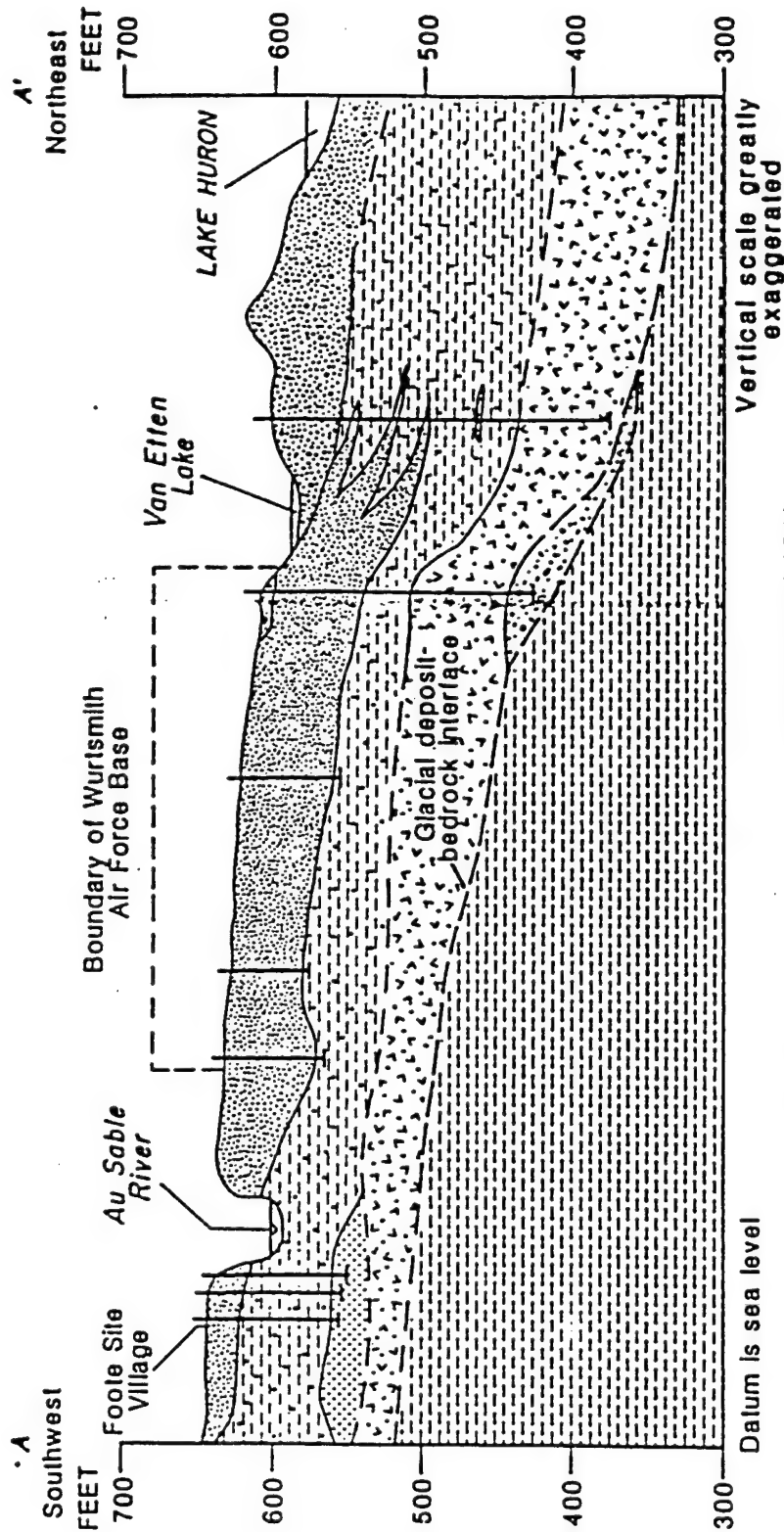
The Soil Conservation Service has identified the Grayling sand as the primary soil association at Wurtsmith AFB (ICF, 1993). The Grayling series consists of excessively drained soils formed in sandy glaciofluvial sediments, with slopes ranging from 0 to 6 percent.

2.2.2 Hydrogeology

Groundwater occurs predominantly in two aquifers, the shallow sands and deeper glacial deposits, separated by the intervening lacustrine clay and silt layer. The clay and silt layer forms an aquitard between the two water-bearing zones and retards downward migration of contaminant plumes (ICF, 1994).

The surficial sand and gravel deposits comprise the principal aquifer in the vicinity of Wurtsmith AFB. Groundwater occurs at depths ranging from less than 10 feet bgs at places in the western part of the Base, to 25 feet bgs near Van Etten Lake. Groundwater levels fluctuate 1 to 3 feet annually. The shallow aquifer is under unconfined water table conditions. Most groundwater beneath Wurtsmith AFB flows to the northeast, toward Van Etten Lake, and a smaller portion, beneath the southern portion of the Base, flows to the south toward the Au Sable River.

Studies performed by the USGS (1990) in 1979-81 and 1982-85 indicated that average groundwater velocities range from 0.8 foot per day (ft/day) in the eastern part of the Base to 0.3 ft/day in the western part. However, results of the 1982-85 study indicated velocities as high as 5 ft/day at some locations.



- EXPLANATION**
- DESCRIPTION OF UNITS**
- Alluvial deposits
 - Beach and eolian sand deposits
 - Deltic sand deposits
 - Lacustrine silt and clay
 - Sand and gravel
 - Till
 - Marshall Formation
 - Coldwater Shale
 - WELL

FIGURE 2.2

REGIONAL GEOLOGIC CROSS SECTION A-A'

Remedial Action Plan
Risk-Based Approach to Remediation
Site OT45

Wurtsmith AFB, Michigan



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2.3 SITE TOPOGRAPHY AND SURFACE WATER HYDROLOGY

Site OT45 and the surrounding area is generally flat, with a surface elevation of approximately 620 feet above msl. Surface features at the site include grass and wooded areas; concrete, asphalt, crushed rock, and steel mesh driveways and parking areas; an office building; and several storage buildings. The northern part of the Base, including Site OT45, slopes very gently to the northeast toward Van Etten Lake, with an average slope of approximately 0.003 foot per foot (ft/ft).

Because of the flat topography and well-drained, sandy soils, most precipitation infiltrates the sandy soils, and as a result, there are no well-developed surface drainage features. There are no bodies of surface water in the immediate vicinity of Site OT45. The bodies of surface water closest to the site are Dry Creek (1,400 feet north) and Van Etten Lake (3,000 feet northeast).

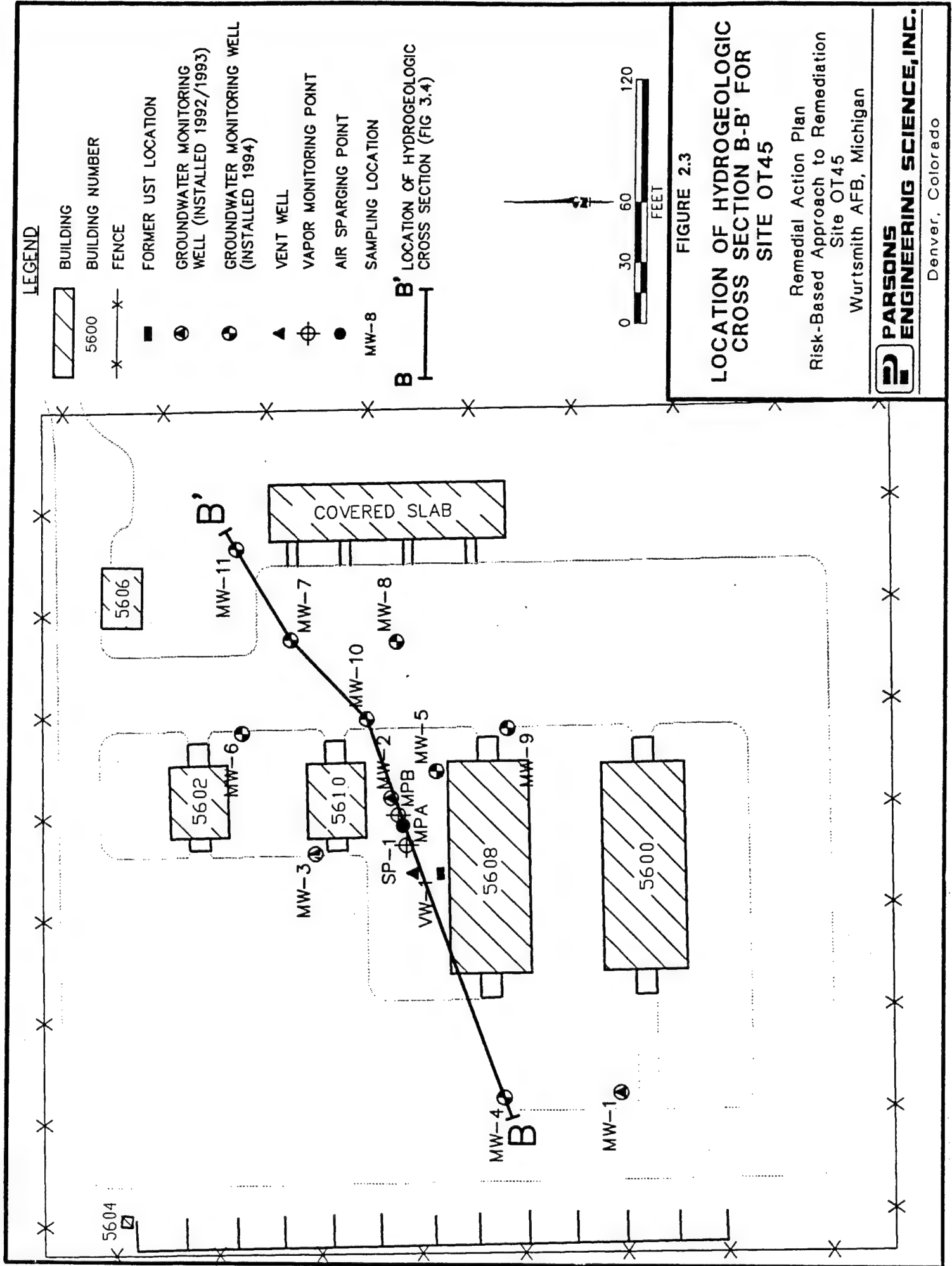
2.4 SITE GEOLOGY AND HYDROGEOLOGY

The vadose zone and shallow aquifer system at Site OT45 were characterized by Parsons ES as part of the initial risk-based investigation during September and October 1994. Data collected as part of this field test were used to supplement geologic and hydrogeologic data collected under the IRP by ICF (1993).

2.4.1 Lithology and Stratigraphic Relationships

Drilling and soil sampling results show that the deposits from the surface to a depth of approximately 70 feet bgs consist predominantly of medium- to very coarse-grained sand overlying slightly silty clay. Figure 2.3 shows the location of cross section B-B' (Figure 2.4), oriented through the center of the source area and parallel to the direction of groundwater flow. The sand deposits are the Pleistocene and younger beach, eolian, and alluvial deposits previously discussed. The sand deposits are poorly to moderately sorted and generally increase in grain size with depth. Occasional gravelly layers were encountered within the sand, with the highest percentage of gravel occurring just above the underlying silty clay layer. A few, thin (generally less than 1 inch thick) silt and silty clay layers were encountered in the upper 20 feet of the sand. One laterally extensive silty clay layer (less than 2 inches thick) was encountered in most soil boreholes at or just below the top of the saturated zone. The sand is a light to medium, yellow- or orange-brown color with iron staining in the upper 10 to 15 feet. In the source area, fuel contamination and biological activity have stained the sand a medium gray to gray-brown.

A clay layer was encountered at depths of between 66 and 70 feet bgs in three soil boreholes (MW-2, MW-3, and MW-10). This clay appears to be the top of the regionally continuous lacustrine clay layer that overlies the glacial till. No soil boreholes were drilled deeper than the top of the clay layer at a depth of 70 feet bgs. The clay layer is a gray, very stiff to hard, silty clay. The hard texture and high clay content of the clay layer indicates very low permeability to groundwater flow.



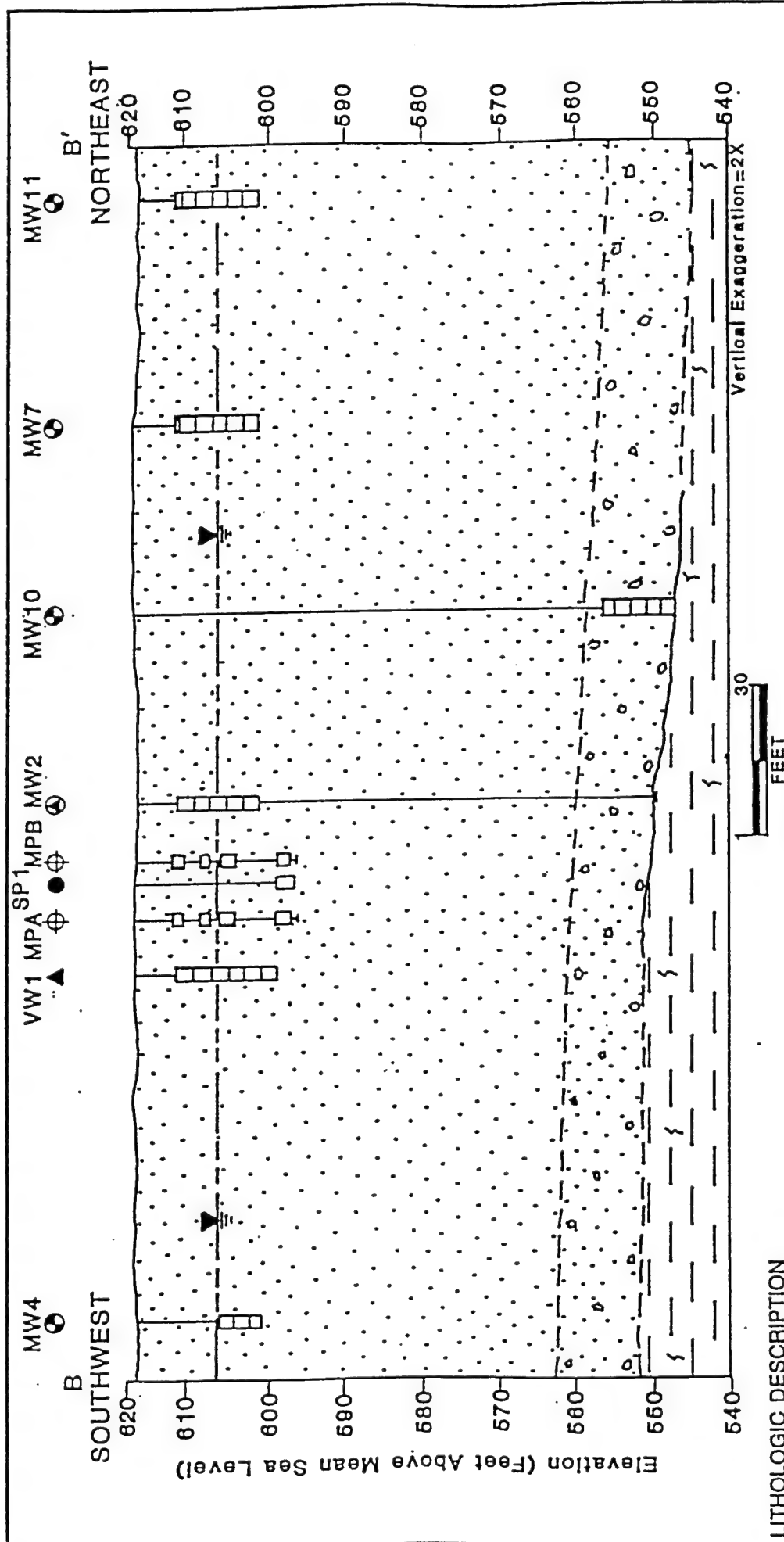


FIGURE 2.4

HYDROGEOLOGIC CROSS SECTION B-B'

Remedial Action Plan
Risk-Based Approach to Remediation
Site OT45

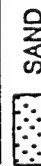
Wurtsmith AFB, Michigan



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LITHOLOGIC DESCRIPTION



SAND



GRAVELLY SAND WITH
CLAY LENSES



SILTY CLAY

LEGEND



MW-4
GROUNDWATER
MONITORING WELL (1994)



VW-1
VENT WELL



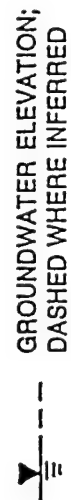
SP-1
AIR SPAGING POINT



MPA
VAPOR MONITORING POINT



MW-2
GROUNDWATER
MONITORING WELL (1992/1993)



GROUNDWATER ELEVATION;
DASHED WHERE INFERRED



GEOLOGIC CONTACT,
DASHED WHERE INFERRED



SCREENED INTERVAL

2.4.2 Site Hydrogeology

The water table depth at the time of well installation was approximately 10 feet bgs. Groundwater elevation data collected in October 1994 were used to construct the map of the approximate groundwater surface at Site OT45 presented in Figure 2.5. According to historic groundwater elevation data, water table elevations fluctuate approximately 1 to 3 feet annually, depending on precipitation (USGS, 1990).

Based on groundwater levels measured in site wells on October 21, 1994, shallow groundwater flow is generally to the east-northeast toward Van Etten Lake with a hydraulic gradient of 0.0042 ft/ft. The gradient appears to be uniform across the site.

The average hydraulic conductivity in the upper portion of the shallow aquifer was determined to be 110 ft/day based on slug tests performed at MPA, MW-4, MW-7, and MW-11. Hydraulic conductivity values ranged from 81 ft/day at MPA to 147 ft/day at MW-7. The average groundwater linear velocity in the shallow portion of the aquifer was calculated to be approximately 1.3 ft/day based on an average hydraulic conductivity of 110 ft/day, a gradient of 0.0042 ft/ft, and an assumed porosity of 0.35. The hydraulic conductivity in the deep portion of the shallow aquifer was determined to be 48 ft/day based on slug tests performed at MW-10. The groundwater linear velocity in the deep portion of the aquifer was determined to be 0.58 ft/day based on a hydraulic conductivity of 48 ft/day, an assumed porosity of 0.35, and assuming a hydraulic gradient of 0.0042 ft/ft (i.e., the gradient for the shallow portion of the aquifer).

2.5 CLIMATE CHARACTERISTICS












The climate at Wurtsmith AFB is humid with cold winters and short, mild summers. Mean monthly temperatures range from 21 degrees Fahrenheit (°F) in January to 68°F in July, with a mean annual temperature of 44°F. The maximum recorded temperature is 102°F, and the minimum is -22°F. Average yearly precipitation is about 30 inches, including approximately 50 inches of snow. The highest monthly precipitation (3.1 inches) normally occurs in June, and the lowest (1.6 inches) occurs in January. The prevailing wind is from the east (Lake Huron).

2.6 LAND USE

2.6.1 Site Access

Site OT45 is located near the center of the former DRMO yard, which is completely enclosed by an 8-foot-high chain-link fence topped with barbed wire. The only site access is through a locked gate located along the northern fence line near the northeast corner of the site. The interior areas of the DRMO compound are accessed via gravel driveways and staging areas. The site area is within the boundaries of Wurtsmith AFB, which is completely enclosed by a similar chain-link fence. The main access to the Base is through the main gate located on County Road F-41.

LEGEND

-  BUILDING
-  BUILDING NUMBER
-  FENCE
-  FORMER UST LOCATION
-  GROUNDWATER MONITORING WELL (INSTALLED 1992/1993)
-  GROUNDWATER MONITORING WELL (INSTALLED 1994)
-  VENT WELL
-  VAPOR MONITORING POINT
-  AIR SPARGING POINT
-  LINE OF EQUAL ESTIMATED GROUNDWATER ELEVATION (FEET ABOVE MSL)
-  GROUNDWATER FLOW DIRECTION

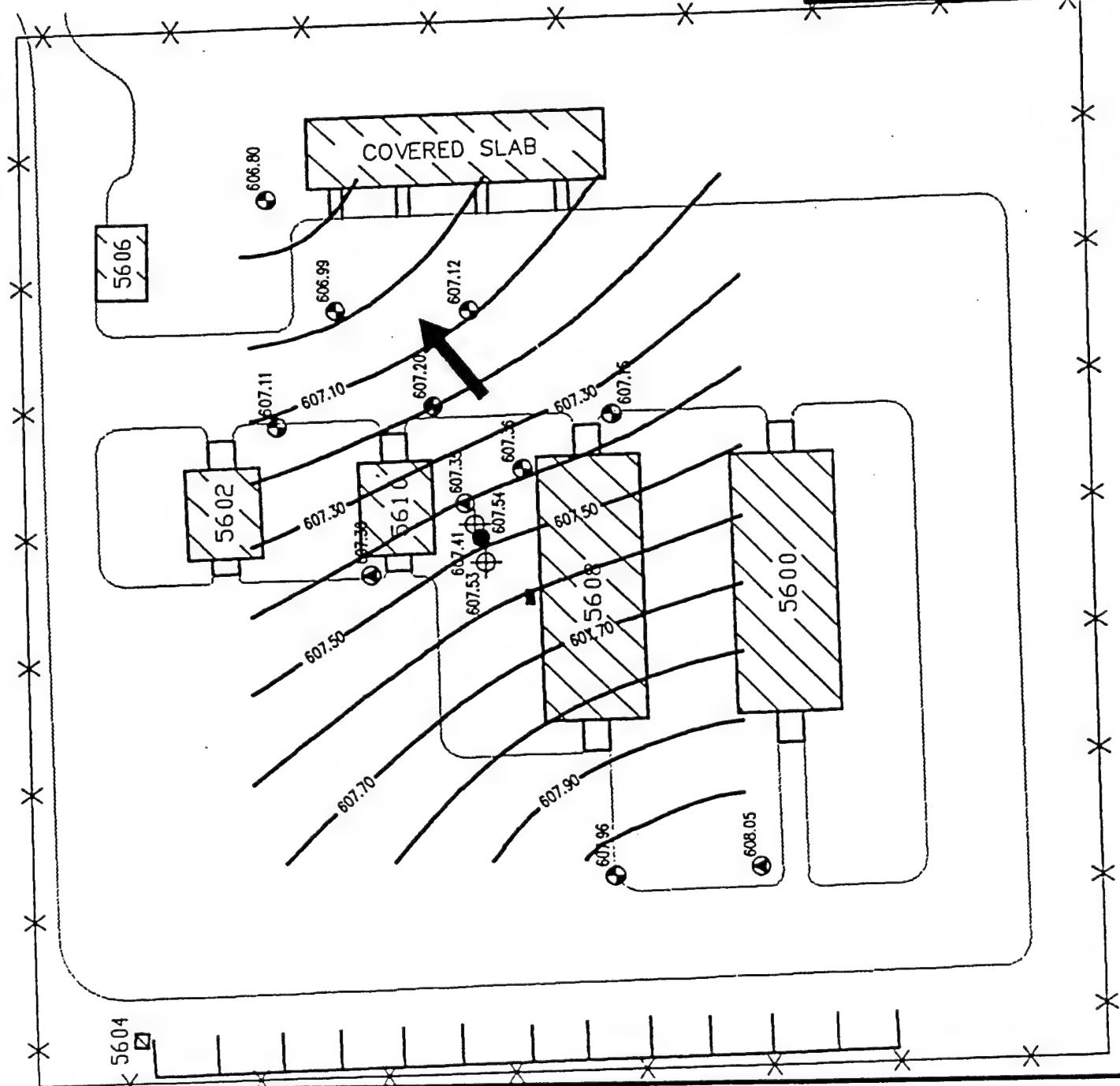


FIGURE 2.5

GROUNDWATER SURFACE ELEVATION MAP OT45 OCTOBER 21, 1994

Remedial Action Plan
Risk-Based Approach to Remediation
Site OT45
Wurtsmith AFB, Michigan



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2.6.2 Current Land Use

Due to the site's proximity to other facilities in the northern part of the Base, the current land use at Site OT45 could be conservatively classified as industrial. The site has been made available for several short-term RIs and treatability studies to develop data to be used to support land use/property disposal decisions.

Parcels of land immediately adjacent to Site OT45 to the north and northeast are owned by either the federal government or the State of Michigan. These parcels are zoned as forestry land, and are currently used as public facilities and/or recreation areas. The only occupied building in the vicinity of Site OT45 is the MDEQ field office located approximately 400 feet to the northeast (across County Road F-41) from the Base boundary, and 900 feet from Building 5608 (former UST location). The only other human habitation in the downgradient groundwater direction is at Camp Nissokone, a YMCA camp on Van Etten Lake, located approximately 2,500 feet from Site OT45. The nearest residential population is located approximately 3,000 feet north of Site OT45 near Van Etten Lake.

2.6.3 Proposed Land Use

Wurtsmith AFB was placed on the 1991 Department of Defense Base Closure and Realignment Commission's list for closure. Wurtsmith AFB was officially closed on June 30, 1993. The Air Force plans to dispose of excess and surplus real property and facilities as soon as environmental restoration is achieved, and pursuant to specific federal property disposal regulations and local community reuse plans (US Air Force, 1993). The Air Force is prepared to execute interim or long-term leases that provide maximum control over the property for some portions of the Base, and some restrictions may be necessary to ensure the protection of human health.

The Air Force, as part of the land disposal and reuse process, has been required to consult with the governor of Michigan and heads of local governments while developing conceptual property reuse plans for Wurtsmith AFB. The redevelopment agency and advisory group, authorized in January 1992 to develop potential reuse options for Wurtsmith AFB, is the Wurtsmith Area Economic Adjustment Commission (WAEAC). WAEAC is composed of a Coordinating Committee (whose membership consists of one representative each from the Boards of Trustees of Oscoda, Au Sable, and Greenbush Townships; one each from the Boards of Commissioners of Iosco and Alcona Counties; and two from the Oscoda community at large), community advisory committees, and a management and liaison office.

WAEAC makes land use recommendations to the Oscoda Township Board of Trustees, who have the authority to make decisions regarding land use options. Any recommendations from the Oscoda Township Board of Trustees on land use related to Wurtsmith AFB property are referred to the Air Force Base Conversion Agency (AFBCA), which acts as the holding agency for receipt, maintenance, and disposition of Base property under the authority of the Michigan Department of Commerce. WAEAC and the Oscoda Township Board of Trustees selected The Pathfinders, Inc. to develop a final land reuse plan for Wurtsmith AFB property. The final plan (US Air Force, 1993) was approved by the Oscoda Township Board of Trustees in December 1992.

Based on the approved final Environmental Impact Statement, and land reuse plan, Site OT45 is proposed to be reused as a commercial property dedicated to convention/tourist services (US Air Force, 1993). The planned use of this site will result in unrestricted public access, but actual occupancy will be nonresidential, intermittent in frequency, and of short duration. Most of the proposed activities will be conducted indoors, and outdoors activities will be minimal. Properties immediately to the southeast and south are proposed to be reused as industrial property, specifically light industrial, warehousing, and light manufacturing. These workers could spend the majority of their workdays outside, although most primary duties will be restricted to buildings and paved areas. The proposed land use for Site OT45 and adjacent environs is described in the *Preliminary Final Environmental Impact Statement: Disposal and Reuse of Wurtsmith Air Force Base, Michigan* (US Air Force, 1993). Additional information and figures showing current and proposed land use in and around the site are included in the *Draft Final Remedial Action Plan for Risk-Based Remediation of Site OT45*. (Parsons ES, 1996)

2.7 GROUNDWATER USE

Two separate water supply systems are available to meet potable and nonpotable off-Base water demands. The Oscoda Township water supply serves Oscoda and Au Sable using groundwater drawn from a shallow-aquifer well field located on the south side of the Au Sable River, which is south of the Base. Shallow groundwater is used to meet potable water demands in this area because the groundwater in the hydrogeologic units beneath the silty clay aquitard generally has high dissolved solids or high chloride concentrations, thus making it an unsuitable drinking water supply. The East Tawas water system, which serves Tawas City, the city of East Tawas, and a part of Baldwin Township, draws its water from Lake Huron (Figure 1.1).

Water for Base facilities has been supplied by Oscoda Township since April 1997. Therefore, there is no need (or plan) to continue extraction of groundwater from the shallow aquifer at Site OT45 (or any area on-Base) to meet future water supply demands.

A potable water well currently exists in the DRMO area but, has not been used since June 1993. Groundwater use restrictions have been imposed on areas where shallow groundwater contamination exists or is suspected to exist. All current lease transfers or future deed transfers on Wurtsmith AFB include prohibitions on groundwater use in potentially contaminated areas. The Michigan Department of Public Health has indicated that the existing on-Base wells could be used after closure, provided that extensive testing is conducted to monitor water quality (US Air Force, 1993).

SECTION 3

SOIL AND GROUNDWATER SAMPLING

3.1 OVERVIEW

This section summarizes the nature and extent of chemicals of interest in soil and the dissolved chemicals in site groundwater. Analytical data for only these chemicals are presented in order to focus the remainder of this DD on these chemicals that could pose a risk to human health. The analytical data presented in this section include results from the 1992 RI, the 1994 risk-based remediation field investigation, the 1995, 1996, and 1997 groundwater sampling events and the 1996 soil sampling event. Additionally, soil gas and soil flux sampling data, which are used to estimate the areal extent of soil contamination and to identify completed exposure pathways are summarized in this section.

3.2 SOURCES OF CONTAMINATION

Contamination at Site OT45 was confirmed to be the result of an underground spill from a former 1,000-gallon UST used to store heating fuel. The tank was taken out of service in October 1991, and removed in 1992 (ICF, 1993). Site characterization efforts conducted at the site previous to 1994 indicated that ethylbenzene, toluene, total xylenes, fluorene, naphthalene, and phenanthrene were potential contaminants of concern. These investigations suggested that concentrations of ethylbenzene, phenanthrene, naphthalene, and fluorene in soil could result in groundwater contamination which exceeded MDEQ residential criteria. However, results of extensive soil sampling in the source area in 1996 indicate that contaminant concentrations have naturally attenuated to levels which are below MDEQ residential criteria.

3.3 SOIL GAS SAMPLING RESULTS

Soil gas samples collected at Site OT45 during the 1994 risk-based field effort were analyzed for volatile BTEX compounds and TVH contamination. Soil gas samples can be used as secondary confirmation of the nature and extent of soil contamination at a site. Soil gas samples can be used to obtain a better representation of soil contamination because the sample is extracted from a larger volume of soil than discrete soil grab samples. Analytical results from soil samples are usually nonhomogenous and can vary from sampling location to sampling location. Thus, soil gas samples provide a valuable indication of the type and magnitude of volatile organic contamination in the soil.

Soil gas samples were collected from VW-1, MPB, and MW-2 in October 1994 (Figure 3.1). Benzene was not detected in any of the three soil gas samples. This is consistent with soil data collected at the site. The only BTEX compounds detected in soil gas samples were ethylbenzene and total xylenes. These compounds were detected in all three soil gas samples collected at Site OT45 during the 1994 risk-based investigation. The maximum concentration of ethylbenzene [1.4 milligrams per cubic meter (mg/m^3)] was detected in the soil gas sample collected at MPB; the minimum concentration ($0.17 \text{ mg}/\text{m}^3$) was measured at MW-2. The maximum concentration of total xylenes ($3.2 \text{ mg}/\text{m}^3$) was measured at MPB; the minimum ($1 \text{ mg}/\text{m}^3$) was measured at MW-2.

These results support the 1994 soil sampling analytical results, which indicate minimal BTEX soil contamination. All of the measured soil gas concentrations are well below the time-weighted-average (TWA), 8-hour permissible exposure limits (PELs) defined for air contaminants by the Occupational Safety and Health Administration (OSHA, 1995). Consequently, if future excavation of these soils proves to be necessary to support remedial or construction activities, soil gas concentrations are not expected to pose a significant risk to potential human receptors. All analytical results for soil gas samples collected during the 1994 field effort are presented in Appendix B.

3.4 SOIL CHEMISTRY

Soil chemicals of interest appear to be limited to saturated and capillary fringe soils, and were not detected in unsaturated soil samples collected during either the 1992 or the 1994 sampling events. During the 1996 confirmation soil sampling event, no chemicals of interest were detected in the saturated and capillary fringe soils above the most stringent residential soil cleanup criteria. All analytical results for soil samples collected during the 1992 RI, the 1994 risk-based field efforts, and the 1996 confirmation soil sampling event are presented in Appendix B.

3.4.1 1996 Sampling Event

The 1996 confirmation soil sampling event was completed to verify predictions of reductions in contaminant concentrations with time at the site. Twelve soil samples near the source area and two background samples were collected from the smear zone just above and below the groundwater surface (Table 3.1). The only detectable level of phenanthrene in the soil was at soil sample location C7 at a concentration of $21 \text{ } \mu\text{g}/\text{kg}$ which was below the laboratory reporting limit (Figure 3.2). Therefore, there are currently no concentrations of 1,2,4-TMB (or any other contaminant) in site soil above the most stringent residential soil cleanup criteria. These reductions in contaminant concentrations are consistent with the predicted natural attenuation occurring at the site.

3.5 GROUNDWATER CHEMISTRY

The following sections describe the results of groundwater sampling events conducted during the 1992 RI, and the 1994/1995 risk-based field investigations, and the 1996/1997 groundwater verification sampling event. Only chemicals in groundwater that are present onsite at concentrations exceeding any of the MDEQ (1995a) generic residential groundwater cleanup criteria during the previous

LEGEND

- BUILDING
- BUILDING NUMBER
- FENCE
- FORMER UST LOCATION
- SOIL GAS AND SURFACE SOIL GAS FLUX SAMPLE LOCATION
- BACKGROUND SOIL GAS FLUX SAMPLING LOCATION



5600



5606



MPB



MW-2



VW-1



5602



5610



5608



5600



5606



COVERED SLAB



5604



BKG



5600



5608



5600

5606

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TABLE 3.1
SOIL CONCENTRATIONS OF
CHEMICALS OF POTENTIAL CONCERN
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT45, WURTSMITH AFB, MICHIGAN

| WELLS | COMPOUND | ANALYTICAL RESULTS | UNITS | FEET BELOW |
|-------|------------------------|----------------------|-------|--------------|
| | | July and August 1996 | | GROUND SURF. |
| C1 | 1,2,4-Trimethylbenzene | 5.1U | µg/kg | (8-11) |
| | Phenanthrene | 420u | µg/kg | (8-11) |
| C2 | 1,2,4-Trimethylbenzene | 4.7U | µg/kg | (8-11) |
| | Phenanthrene | 390U | µg/kg | (8-11) |
| C3 | 1,2,4-Trimethylbenzene | 4.5U | µg/kg | (8-11) |
| | Phenanthrene | 370U | µg/kg | (8-11) |
| C4 | 1,2,4-Trimethylbenzene | 4.5U | µg/kg | (8-11) |
| | Phenanthrene | 370U | µg/kg | (8-11) |
| C5 | 1,2,4-Trimethylbenzene | 4.6U | µg/kg | (8-11) |
| | Phenanthrene | 380U | µg/kg | (8-11) |
| C6 | 1,2,4-Trimethylbenzene | 4.6U | µg/kg | (8-11) |
| | Phenanthrene | 380U | µg/kg | (8-11) |
| C7 | 1,2,4-Trimethylbenzene | 2.7J | µg/kg | (8-11) |
| | Phenanthrene | 21J | µg/kg | (8-11) |
| C8 | 1,2,4-Trimethylbenzene | 4.6U | µg/kg | (8-11) |
| | Phenanthrene | 380U | µg/kg | (8-11) |
| C9 | 1,2,4-Trimethylbenzene | 4.7U | µg/kg | (8-11) |
| | Phenanthrene | 390U | µg/kg | (8-11) |
| C10 | 1,2,4-Trimethylbenzene | 4.8U | µg/kg | (8-11) |
| | Phenanthrene | 390U | µg/kg | (8-11) |
| C11 | 1,2,4-Trimethylbenzene | 4.8U | µg/kg | (8-11) |
| | Phenanthrene | 400U | µg/kg | (8-11) |
| C12 | 1,2,4-Trimethylbenzene | 4.7U | µg/kg | (8-11) |
| | Phenanthrene | 390U | µg/kg | (8-11) |

TABLE 3.1 (Continued)
SOIL CONCENTRATIONS OF
CHEMICALS OF POTENTIAL CONCERN
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT45, WURTSMITH AFB, MICHIGAN

| WELLS | COMPOUND | ANALYTICAL RESULTS | UNITS | FEET BELOW |
|-------|------------------------|----------------------|-------|--------------|
| | | July and August 1996 | | GROUND SURF. |
| C13 | 1,2,4-Trimethylbenzene | 4.5U | µg/kg | (8-11) |
| | Phenanthrene | 380U | µg/kg | (8-11) |
| C14 | 1,2,4-Trimethylbenzene | 4.6U | µg/kg | (8-11) |
| | Phenanthrene | 380U | µg/kg | (8-11) |

U = Analyte not detected above method detection limit.

J = Estimated value.



investigations are described in detail. No free product [light nonaqueous-phase liquid (LNAPL)] has been observed at the site.

3.5.1 1992-1994 Sampling Event

Results of the 1992 and 1994 sampling events indicated that, at various times, phenanthrene, 1,2,4-TMB, and 1,3,5-TMB were detected at levels above generic residential groundwater cleanup criteria in several wells near the source area. Affected wells include MW-2, MW-5, VW-1 and MPB. Not all three chemicals were detected in each well during each sampling event.

A total of 18 groundwater samples were collected during this period. The maximum concentration detected was phenanthrene at 1,500 µg/L in MW-2 during the 1992 sampling event. Phenanthrene in MW-2 in 1994 was detected at 70 µg/L. During the 1994 sampling event the remaining chemicals of concern exceeding residential cleanup criteria ranged from 36 to 82 µg/L.

3.5.2 1995 Sampling Event

Results of the October 1995 sampling event demonstrate that concentrations of dissolved chemicals are rapidly decreasing at Site OT45. In October of 1995 1,2,4-TMB was the only dissolved chemical detected in onsite groundwater at concentrations greater than its residential health-based cleanup criterion of 30µg/L (Table 3.2). The 1,2,4-TMB was detected at MW-2, in the vicinity of the former UST, at a concentration of 48µg/L. All other concentrations of 1,2,4-TMB measured in groundwater samples collected during the 1995 sampling event were less than 7 µg/L. Groundwater sampling locations (MW-2, MW-4, MW-5, MW-7, MW-10, MW-11, MPB, and VW-1 [W-OT45]) were selected based on a review of the 1994 risk-based investigation results.

3.5.3 1996/1997 Sampling Event

The results of the November 1996, June 1997 and November 1997 sampling events demonstrate that concentrations of dissolved chemicals have, with one exception in one well, decreased to levels below residential criteria. A limited number of sampling locations were selected based on results from previous sampling events (1994 and 1995). Wells near the source area and downgradient of the source area were sampled during the 1996 and 1997 events. No detectable levels of 1,2,4-TMB or 1,3,5-TMB were detected near the source area (MW-2) during the 1996 sampling event. 1,2,4-TMB and 1,3,5-TMB were detected at concentrations of 1 µg/L and 6 µg/L, respectively, downgradient of the source area (MW-7) during the 1996 sampling event (Table 3.2). These levels are below generic residential cleanup criteria.

Three wells near the source area (MW-2, MW-5, and VW-1) were sampled during the June 1997 sampling event. No detectable levels of 1,2,4-TMB or 1,3,5-TMB were found in any of the samples collected during this event (Table 3.2).

Two wells were sampled in the November, 1997 sampling event. Levels of 1,3,5-TMB were found to be below detection limits in MW-11 and 4 µg/L in MW-2. Levels of 1,2,4-TMB were below detection limits in MW-11 and 41 µg/L in MW-2. MW-2 is

TABLE 3.2
DISSOLVED CONCENTRATIONS OF
CONTAMINANTS OF INTEREST
NO FURTHER REMEDIAL ACTION PLANNED DECISION DOCUMENT
SITE OT45, WURTSMITH AFB, MICHIGAN

| WELLS | COMPOUND | ANALYTICAL RESULTS | | | | UNITS |
|----------------------|------------------------|--------------------|--------|--------|--------|-------|
| | | Oct-95 | Nov-96 | Jun-97 | Nov-97 | |
| MW-11 | 1,3,5-Trimethylbenzene | 0.5 U | NA | NA | 1.0 U | µg/L |
| | 1,2,4-Trimethylbenzene | 0.5 U | NA | NA | 1.0 U | µg/L |
| | Phenanthrene | 0.5 U | NA | NA | NA | µg/L |
| MW-7 | 1,3,5-Trimethylbenzene | 5.4 | 6 | NA | NS | µg/L |
| | 1,2,4-Trimethylbenzene | 1.8 | 15 | NA | NS | µg/L |
| | Phenanthrene | 0.5 U | NA | NA | NS | µg/L |
| MW-10 (deep well) | 1,3,5-Trimethylbenzene | 0.4 U | NA | NA | NS | µg/L |
| | 1,2,4-Trimethylbenzene | 0.4 U | NA | NA | NS | µg/L |
| | Phenanthrene | 0.5 U | NA | NA | NS | µg/L |
| MW-5 | 1,3,5-Trimethylbenzene | 4.3 | NA | 0.5U | NS | µg/L |
| | 1,2,4-Trimethylbenzene | 15 | NA | 0.5U | NS | µg/L |
| | Phenanthrene | 0.5 U | NA | NA | NS | µg/L |
| MPB | 1,3,5-Trimethylbenzene | 0.4 U | NA | NA | NS | µg/L |
| | 1,2,4-Trimethylbenzene | 1.5 | NA | NA | NS | µg/L |
| | Phenanthrene | 0.5 U | NA | NA | NS | µg/L |
| VW-1 | 1,3,5-Trimethylbenzene | 2.4 | NA | 0.5U | NS | µg/L |
| | 1,2,4-Trimethylbenzene | 6.4 | NA | 0.5U | NS | µg/L |
| | Phenanthrene | 0.5 U | NA | NA | NS | µg/L |
| MW-2 | 1,3,5-Trimethylbenzene | 8.7 | 0.2U | 0.5U | 4.0 | µg/L |
| | 1,2,4-Trimethylbenzene | 48 | 0.2U | 0.5U | 41.0 | µg/L |
| | Phenanthrene | 6 J | NA | NA | NA | µg/L |
| MW-3 | 1,3,5-Trimethylbenzene | NS | NA | NA | NS | µg/L |
| | 1,2,4-Trimethylbenzene | NS | NA | NA | NS | µg/L |
| | Phenanthrene | NS | NA | NA | NS | µg/L |
| MW-6 | 1,3,5-Trimethylbenzene | NS | NA | NA | NS | µg/L |
| | 1,2,4-Trimethylbenzene | NS | NA | NA | NS | µg/L |
| | Phenanthrene | NS | NA | NA | NS | µg/L |

TABLE 3.2 (Continued)
DISSOLVED CONCENTRATIONS OF
CONTAMINANTS OF INTEREST
NO FURTHER REMEDIAL ACTION PLANNED DECISION DOCUMENT
SITE OT45, WURTSMITH AFB, MICHIGAN

| WELLS | COMPOUND | ANALYTICAL RESULTS | | | | UNITS |
|-------|------------------------|--------------------|--------|--------|--------|-------|
| | | Oct-95 | Nov-96 | Jun-97 | Nov-97 | |
| MW-8 | 1,3,5-Trimethylbenzene | NS | NA | NA | NS | µg/L |
| | 1,2,4-Trimethylbenzene | NS | NA | NA | NS | µg/L |
| | Phenanthrene | NS | NA | NA | NS | µg/L |
| MW-9 | 1,3,5-Trimethylbenzene | NS | NA | NA | NS | µg/L |
| | 1,2,4-Trimethylbenzene | NS | NA | NA | NS | µg/L |
| | Phenanthrene | NS | NA | NA | NS | µg/L |
| MW-1 | 1,3,5-Trimethylbenzene | NS | NA | NA | NS | µg/L |
| | 1,2,4-Trimethylbenzene | NS | NA | NA | NS | µg/L |
| | Phenanthrene | NS | NA | NA | NS | µg/L |
| MW-4 | 1,3,5-Trimethylbenzene | 0.4 U | NA | NA | NS | µg/L |
| | 1,2,4-Trimethylbenzene | 0.4 U | NA | NA | NS | µg/L |
| | Phenanthrene | 0.5 U | NA | NA | NS | µg/L |

NA = Data not available for comparison.

U = Analyte not detected above method detection limit.

NS = Not sampled.

near the source area and the 41 µg/l of 1,2,4-TMB is above the residential cleanup limit of 30 µg/L, but below the commercial/industrial limit of 86 µg/l.

The 1996 and the June 1997 sampling events indicate that dissolved phase 1,2,4-TMB and 1,3,5-TMB existed at concentrations below the most restrictive MDEQ (1995a) generic health-based residential groundwater cleanup criterion of 30 µg/L and 23 µg/L. The November 1997 sampling event shows that 1,2,4-TMB in MW-2 is slightly above the residential cleanup criterion, but remains below the commercial / industrial criterion. These slight variations in 1,2,4-TMB above and below the residential criteria are likely to continue due to seasonal changes in groundwater elevation which expose the source area groundwater to varying degrees of soil contamination.

SECTION 4

EXPOSURE ASSESSMENT

Wurtsmith AFB was officially closed on June 30, 1993. Based on the approved final land reuse plan, Site OT45 has been set aside for potential commercial development (convention center) (US Air Force, 1993). Surrounding land use is primarily industrial. The site was formerly used as a storage and staging area for DRMO operations, and is currently vacant except for intermittent remediation investigations and efforts. Site OT45 is located about 200 feet upgradient from the nearest Base property boundary, which borders US government and State of Michigan parcels that are zoned forestry land, and are currently used as recreation areas/public facilities. Additionally, there are some residences outside of the Base boundary near Van Etten Lake, which is approximately 3,000 feet downgradient from the site.

Considering the land use plans for this site and the limited activities currently taking place in the area, the site will continue to be maintained as an industrial area until completion of any convention/tourist center. After completion of the convention/tourist facilities, site activities are anticipated to be similar to the activities and exposure assumptions for the commercial subcategory IV site described in Operational Memorandum #14 (MDEQ, 1995b).

Based on these land use assumptions, onsite industrial workers and eventually commercial subcategory IV workers and visitor populations are the only current or likely future onsite human receptors. As there are no long-term plans for the use of groundwater from the shallow affected aquifer, and as depth to groundwater at the site is about 10 feet bgs, current onsite workers could reasonably be exposed only to impacted surface soils and to air potentially affected by chemicals volatilizing from subsurface media in the absence of any deep (10 feet bgs or more) excavation activities. However, future workers could also include those involved in construction or other intrusive maintenance activities. Therefore, future onsite workers could be exposed to contaminants in surface and subsurface soils, air, and, conservatively, shallow groundwater.

No exposure pathways to current offsite receptors are believed to be completed. In light of the existence of off-Base potable water wells completed in the affected shallow aquifer, future offsite human receptors could potentially be exposed to site contaminants through ingestion or inhalation of, or dermal contact with, contaminants in groundwater extracted for potable use. However, the nearest residential area using shallow groundwater is over 3,000 feet from the site, and downgradient contaminant migration from the site to date is less than 200 feet.

Although numerous plant and wildlife species are known to occur on and near Wurtsmith AFB, the absence of contaminant migration pathways in media to which wildlife or plants could readily be exposed (e.g., surface water and shallow soils) indicates that no ecological receptors are likely to be exposed to contaminants in site media under current or anticipated future land uses.

A more detailed exposure assessment, including a conceptual site model, and chemical fate assessment is provided in the *Draft Final Remedial Action Plan for the Risk-Based Remediation of Site OT45* (Parsons ES 1996)

SECTION 5

SUMMARY

Site OT45 has very little soil and groundwater contamination remaining. The lack of soil contamination is evidenced by results from 14 soil samples collected in 1996 from the smear zone in the area around the tank pit source area. Soil concentrations of chemicals of concern are below residential direct contact clean-up criteria. A listing of maximum detected concentrations and residential direct contact clean-up criteria is provided in Table 5.1. Note that none of the maximum soil concentrations exceeds any clean-up criteria.

The lack of groundwater contamination is evidenced by the 1996 and June 1997 groundwater sampling in which no exceedances of residential health-based cleanup criteria were observed. The November 1997 sampling event indicates that MW-2 contains levels of 1,2,4-TMB slightly above residential cleanup criteria, but below commercial / industrial criteria. Table 5.2 contains maximum detected concentrations from the 1996 and 1997 sampling events and residential health-based clean-up criterion. Note that the only exceedance is for one compound in one well. Analysis of all available site groundwater data shows a decreasing trend in chemical concentrations from initial sampling in 1992 until 1997.

TABLE 5.1
COMPARISON OF SOIL RESULTS TO CLEAN-UP CRITERIA
NO FURTHER REMEDIAL ACTION PLANED DECISION DOCUMENT
SITE OT45, WURTSMITH AFB, MICHIGAN

| Analytes | Maximum Detected Concentrations | Residential Direct Contact | Residential Leaching to Groundwater | 1996 Max. Conc. Exceeds Any Criteria | Units |
|---------------------------------|---------------------------------------|----------------------------------|---|---|-------|
| | 1996 | | | | |
| Acenaphthene | <420 | 7.60E+07 | 3.00E+05 {M} | No | µg/kg |
| Benzo(a)anthracene {Q} {DC} | <420 | 14,000 | {E} | No | µg/kg |
| Benzo(a)pyrene {Q} {DC} | <420 | 1,400 | {E} | No | µg/kg |
| Benzo(b)fluoranthene {Q} {DC} | <420 | 14,000 | {E} | No | µg/kg |
| Benzo(g,h,i)perylene | <420 | 1.50E+06 | {E} | No | µg/kg |
| Benzo(k)fluoranthene {Q} {DC} | <420 | 1.40E+05 | {E} | No | µg/kg |
| Chrysene {Q} {DC} | <420 | 1.40E+06 | {E} | No | µg/kg |
| Dibenzofuran | <420 | {ID} | {ID} | -- | µg/kg |
| Ethylbenzene | 0.6 | >C _{sat} (3.80E+05) | 1,500 | No | µg/kg |
| Fluoranthene | <420 | 5.10E+07 | 3.00E+06 {M} | No | µg/kg |
| Fluorene | <420 | 5.10E+07 | 3.90E+05 {M} | No | µg/kg |
| Indeno(1,2,3-cd)pyrene {Q} {DC} | <420 | 14,000 | {E} | No | µg/kg |
| 2-Methylnaphthalene | 110 | 1.50E+07 | 5,200 | No | µg/kg |
| Naphthalene | 35 | 1.50E+07 | 17,000 {M} | No | µg/kg |
| Phenanthrene | 21 | 1.50E+06 | 12,000 {M} | No | µg/kg |
| Pyrene | 58 | 3.20E+07 | 1.80E+06 {M} | No | µg/kg |
| Toluene | 0.9 | >C _{sat} (6.20E+05) | 16,000 | No | µg/kg |
| 1,2,3-Trimethylbenzene | 1.3 | -- | -- | -- | µg/kg |
| 1,2,4-Trimethylbenzene | 2.7 | 4.50E+05 | 600 | No | µg/kg |
| 1,3,5-Trimethylbenzene | 2.3 | 3.40E+05 | 460 | No | µg/kg |
| Total xylenes | 2.3 | >C _{sat} (4.00E+05) | 5,600 | No | µg/kg |

Source: MDNR, 1996.

C_{sat} = Soil saturation value.

{DC} = Chemical is a dermal carcinogen, since it causes skin cancer directly at the point of contact. Value is based on the oral slope factor due to lack of dermal toxicity data.

{E} = Chemical, due to its physiochemical properties, is not expected to leach through soils to groundwater under most conditions.

{ID} = Inadequate data to develop RBSL.

{M} = A linear equilibrium soil/water partitioning equation (SWP) was substituted for the 20X groundwater value where the SWP value was higher. The SWP predicts the contaminant release from soil into soil leachate by relating the concentration of contaminants absorbed to soil organic carbon to the concentration in the soil water and air pore space. The method also accounts for contaminant transport by applying a generic dilution attenuation factor (DAF) to represent the dilution in soil leachate concentrations that result from contaminants mixing in an aquifer. The DAF is defined as the ratio of the soil leachate concentration to the acceptable groundwater concentration. A DAF of 16 was agreed upon by technical staff within the DEQ. The equation can be found in EPA's Soil Screening Guidance, published by the Office of Solid Waste and Emergency Response, Washington, D.C., EPA/540/R95/128 1996

{Q} = RBSLs for carcinogenic polynuclear aromatic hydrocarbons (PNAs) were calculated using "relative potential potencies" (RPPs) to benzo(a)pyrene.

TABLE 5.2
COMPARISON OF GROUNDWATER RESULTS TO CLEAN-UP CRITERIA
NO FURTHER REMEDIAL ACTION PLANNED DECISION DOCUMENT
SITE OT45, WURTSMITH AFB, MICHIGAN

| Analytes | Maximum Detected Concentration | | | Residential Health-Based/ Aesthetic Drinking Water | Industrial Commercial Health-Based | State Drinking Water | 1997 Max. Conc. Exceeds Any | Units |
|----------------------------|--------------------------------|--------|--------|---|--|----------------------------|-----------------------------------|-------|
| | Jun-97 | Nov-96 | Nov-97 | Criterion | Criterion | Standards ^{2/} | Criteria | |
| Acenaphthene | NA | NA | NA | 1,300 | 3,800 | -- | No | µg/L |
| Anthracene | NA | NA | NA | 7,300 | 21,000 | -- | No | µg/L |
| Benzene | <0.5 | <5 | NA | 5 (C) | 5 (C) | 5 | No | µg/L |
| Ethylbenzene | <0.5 | 7 | 4 | 74 (A) | 74 (A) | 700 | No | µg/L |
| Fluorene | NA | NA | NA | 880 | 2,500 | -- | No | µg/L |
| 2-Methylnaphthalene | NA | NA | NA | 260 | 750 | -- | -- | µg/L |
| Naphthalene | NA | NA | 98 | 260 | 750 | -- | No | µg/L |
| Phenanthrene | NA | NA | NA | 26 | 75 | -- | No | µg/L |
| 1,2,3,4-Tetramethylbenzene | 7.4 | NA | NA | -- | -- | -- | -- | µg/L |
| Toluene | <0.5 | <5 | NA | 790 (A) | 790 (A) | 1,000 | No | µg/L |
| 1,2,3-Trimethylbenzene | <0.5 | 1 | NA | -- | -- | -- | -- | µg/L |
| 1,2,4-Trimethylbenzene | <0.5 | 1 | 41 | 30 | 86 | -- | Yes | µg/L |
| 1,3,5-Trimethylbenzene | <0.5 | 6 | 4 | 23 | 65 | -- | No | µg/L |
| Total xylenes | <0.5 | 2 | 6 | 280 (A) | 280 (A) | 10,000 | No | µg/L |

Source: MDNR, 1996.

^{2/} The state drinking water standard must be met onsite if groundwater is used as an onsite potable water source, and the standard is more restrictive than the health-based or aesthetic criteria.

(A) = This identifies the aesthetic value which is more restrictive than the health based value.

(C) = State of Michigan Drinking Water Standard established pursuant to Section 5 of the Safe Drinking Water Act, Public Act 399 of 1976 used as default.

SECTION 6

DESCRIPTION OF THE NFRAP ALTERNATIVE

This section summarizes the recommendation for no further action at Site OT45.

6.1 RECOMMENDATION FOR CLOSURE

Based on the site investigation and evaluations, the potential threat to public health or the environment at Site OT45 is negligible. Due to transient levels of 1,2,4-TMB in MW-2 above residential cleanup criteria, but below commercial / industrial limits, it is recommended that the site be closed under commercial / industrial criteria. Additional sampling of monitoring wells is not proposed at this time and would only be required if groundwater was ever needed for residential use.

The decision for no further remedial action planned (NFRAP) is protective of human health and the environment, attains Federal and State requirements that are applicable or relevant and appropriate, and is cost effective. Site OT45 will be removed from further consideration in the Wurtsmith AFB IRP.

REFERENCES

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APPENDIX A

**BORING LOGS, WELL CONSTRUCTION DIAGRAMS, AND
WELL DEVELOPMENT DATA**

BOREHOLE LOG

| | | | | | |
|---|--|------------------------------|-----|------------------------|---------|
| SITE NAME AND LOCATION Luntsmith AFB DT45 | | DRILLING METHOD: HSA | | BORING NO. MW4-0T45 | |
| | | | | SHEET 1 OF 1 | |
| | | SAMPLING METHOD: Split spoon | | DRILLING | |
| | | | | START | FINISH |
| COLLECTED MS-HSD | | WATER LEVEL | 9.5 | TIME | TIME |
| Temporary well - completed 61 | | TIME | | 15:15 | 15:00 |
| permanant well | | DATE | | DATE | DATE |
| | | CASING DEPTH | | 9/29/94 | 9/29/94 |

| | |
|----------------------|--------------------|
| RL RIG | SURFACE CONDITIONS |
| ANGLE | BEARING |
| SAMPLE HAMMER TORQUE | FT.-LBS |

| ELEVATION | BLOWS/AMF ON SAMPLER (RECOVERY) | CORES | | | | SOL DESCRIPTION OR ROCK LITHOLOGY | SYMBOL | ROCK STRUCTURE | SAMPLER AND BIT | CASING TYPE | BLOWS/FOOT ON CASING | TEST RESULTS | | | |
|-----------|---------------------------------------|---------|-----------------------------------|------------|-----|--|--------|------------------------------|-----------------|-------------|-------------------------|---------------------|----|--------------------------|--|
| | | RUN NO. | NO. AND SIZE OF CORE PIECES | % RECOVERY | ROD | | | | | | | DEPTH IN FEET | | PERMEABILITY CM./SEC. | |
| | | | | | | | | | | | | FROM | TO | | |
| 2 | | | | | | 0-1 SAND f-m 1-2 SAA, orange | | dk brn brn | | | | | | | |
| 4 | | | | | | | | | | | | | | | |
| 6 | 23 54 | | | | | SAND, f-m, tan sm Fe stain, moist | | | | | | 5 | 7 | 22 | |
| 8 | 33 32 | | | | | SAA 9.5 f. gr. md brn -1/2" silty clay @ 9.8 | | Fe stain w/ L drilled 9.5 | | | | 8 | 10 | 4 ppm TKN | |
| 10 | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | |
| 14 | 7, 17 21 21 | | | | | | | | | | | 13 | 15 | TOL 6 ppm | |
| 16 | | | | | | | | | | | | | | | |

Figure A.1
Geologic Boring Log

TD=15'

Figure A.1
Geologic Boring Log

DRILLING CONTR CTI
LOGGED BY JFH
DATE 9/29/94 CHK'D BY RL

BOREHOLE LOG

| | | | | | | |
|--|-------------------------------------|------------|--|--|-------------------------------|----------------|
| SITE NAME AND LOCATION Hurtsmith AFB T45 | DRILLING METHOD: HSA | | | | BORING NO. MW7-0745 | |
| | | | | | SHEET 5 | |
| | SAMPLING METHOD: Split spoon | | | | (1 OF 1) | |
| | | | | | DRILLING | |
| | | | | | START | FINISH |
| WATER LEVEL | | 9.5 | | | TIME | TIME |
| TIME | | | | | 0738 | 09:00 |
| DATE | | | | | DATE | DATE |
| | | | | | 9/29/94 | 9/29/94 |
| CASING DEPTH | | | | | | |

| | | | |
|----------------------|--|--------------------|--|
| DIP & RIG | | SURFACE CONDITIONS | |
| BEARING | | | |
| SAMPLE HAMMER TORQUE | | FT.-LBS | |

| BLOWS/AN ON SAMPLER (RECOVERY) | RUN NO. | CORES | | SOL DESCRIPTION OR ROCK LITHOLOGY | SYMBOL | ROCK STRUCTURE | SAMPLER AND BIT | CASING TYPE | BLOWS/FOOT ON CASING | TEST RESULTS | | | |
|--------------------------------|---------|-----------------------------|------------|-----------------------------------|--------|----------------|-----------------|-------------|----------------------|--------------|---------------|----|-----------------------|
| | | NO. AND SIZE OF CORE PIECES | % RECOVERY | | | | | | | ROD | DEPTH IN FEET | | PERMEABILITY CM./SEC. |
| | | | | | | | | | | | FROM | TO | |

| | | | | | | | | | | | | | |
|-----------------|--|--|--|---|--|---------------------------------------|--|--|--|--|--|--|--|
| 3777 | | | | Sand, dk brn Sand, orange-brn Sand, tan, m-gr nu SAA, f m-gr, f-gr | | moist at 4' | | | | | | | |
| 5956 | | | | SAA, md-gr ~ 1" clay layer | | wet @ 4.5' at 9.4' no odor | | | | | | | |
| 516 32 30 | | | | SAA m-c gr. | | Cuttings, green fuel odor TD=16 | | | | | | | |

Figure A.1
Geologic Boring Log

DRILLING CONTR **CTI**

LOGGED BY **JFH**

DATE **9/29/94** CHK'D BY **RL**

BOREHOLE LOG

| | | | | | | | | | | | |
|--|--|--|--|--|------------------------------|-----|--|--|--|------------------------|---------|
| STATION NAME AND LOCATION Jurtsmith AFB OT45 | | | | | DRILLING METHOD: HSA | | | | | BORING NO. MW6-0745 | |
| | | | | | | | | | | SHEET | |
| | | | | | SAMPLING METHOD: Split Spoon | | | | | OF | |
| | | | | | | | | | | DRILLING | |
| | | | | | | | | | | START | FINISH |
| 10 of Bldg 5602. | | | | | WATER LEVEL | 9.5 | | | | TIME | TIME |
| | | | | | TIME | | | | | 12:40 | 1315 |
| | | | | | DATE | | | | | DATE | DATE |
| | | | | | CASING DEPTH | | | | | 9/29/94 | 9/29/94 |

| | | |
|----------------------|------------|--------------------|
| D 1 RIG | | SURFACE CONDITIONS |
| A | LE BEARING | |
| SAMPLE HAMMER TORQUE | | FT.-LBS |

[illegible]

The image shows a geologic boring log with multiple columns. From left to right, the columns are:

- Depth (ft):** A vertical scale on the far left with markings from 0 to 16 feet.
- Soil Description:** Handwritten notes describing the soil at various depths.
 - 0-1 ft: Sand, m-f gr top
 - 1-2 ft: 6"-1' dk brn, 1'-2' orange-brn
 - 4-5 ft: SAND, tan-orange, med gr
 - 5-6 ft: fine gr
 - 9-10 ft: SAA, Fe stain, interbedded, Fe stain no odor
 - 10-12 ft: SAND, m-c gr, tan
 - 12-14 ft: SAA 1/2" silt layer @ 14'
 - 14-15 ft: TD 15'
- Water Level:** A column with handwritten notes: "WL drilled 9.5' f SAND silt clay, SILT wet no odor".
- Depth (ft):** A vertical scale on the right side of the log, with markings from 0 to 16 feet.
- Test Results:** A column with handwritten notes: "4 6", "8 10", "10 12", "13 15".
- Notes:** A column with handwritten notes: "22p", "Lab spp", "spp", "12p".

The log is titled "Figure A.1 Geologic Boring Log" at the bottom right.

DRILLING CONTR

PL

LOGGED BY TFA

DATE 9/29/94 CLK'D BY

Figure A.1
Geologic Boring Log

BOREHOLE LOG

| | | | | | | |
|---|--------------------|-----|--|-------|------------|--|
| SITE NAME AND LOCATION Jurtsmith AFB OT45 | DRILLING METHOD: | | | | BORING NO. | |
| | HSA 3 1/4 ID | | | | MW 7 | |
| | changed to 4 1/4 | | | | SHEET | |
| | SAMPLING METHOD: | | | | 1 OF 1 | |
| | 0-8 5' core barrel | | | | DRILLING | |
| 8- 2' split spec. | | | | START | FINISH | |
| WATER LEVEL | | 9.0 | | TIME | TIME | |
| TIME | | | | 1650 | 0 | |
| DATE | | | | DATE | DATE | |
| CASING DEPTH | | | | 9/27 | 9/28 | |

| | | | |
|----------------------|--|--------------------|--|
| ELEVATION | | SURFACE CONDITIONS | |
| ACER SOIL MAX | | | |
| BEARING | | | |
| SAMPLE HAMMER TORQUE | | FT.-LBS | |

| BLOWS/AM ON SAMPLER (RECOVERY) | RUN NO. | CORES | | SOL DESCRIPTION OR ROCK LITHOLOGY | SYMBOL | ROCK STRUCTURE | SAMPLER AND BIT | CASING TYPE | BLOWS/FOOT ON CASING | TEST RESULTS | | | |
|--------------------------------------|---------|-----------------------------------|------------|---|--------|-------------------|-----------------|-------------|-------------------------|--------------|---------------------|----|----------------------------------|
| | | NO. AND SIZE OF CORE PIECES | % RECOVERY | | | | | | | ROD | DEPTH IN FEET | | T-11 PERMEABILITY (CM/SEC) |
| | | | | | | | | | | | FROM | TO | |

| | | | | | | | | | | | | |
|--|--|--|--|--|--|-----------------|--|--|--|-----|-----|--------------|
| | | | | Gravel pavement SAND, f-m, tan- orange-brn lam. no odor, moist | | | | | | 0 | 2.5 | 15 ppm |
| | | | | SAA - 5' light color, ~ 1/3" silt @ ~ 7' | | | | | | 2.5 | 7.5 | 8ppm |
| | | | | SAND, f-m, thin sl clayey silt lenses ~ Fe stain, no odor SAND, f-m, tan wet no odor | | WL drilled - 9' | | | | 8 | 10 | 16ppm lab |
| | | | | SAA, incr. gr size coarse-VC @ 17' | | TDC 15' 1823 | | | | | | |

DRILLING CONTR **CTI**

RL

LOGGED BY **JFH**

DATE **9/27/94** CHK'D BY

Figure A.1
Geologic Boring Log

Contnt. # water in bag 20-30 ppm

BOREHOLE LOG

| | | | | | |
|--|--|------------------------------|--|------------------------|---------|
| SITE NAME AND LOCATION Surt Smith AFB OT45 | | DRILLING METHOD: HSA | | BORING NO. MW8-OT45 | |
| | | | | SHEET 1 OF 1 | |
| | | SAMPLING METHOD: Split Spoon | | | |
| | | | | DRILLING | |
| | | | | START | FINISH |
| WATER LEVEL | | 9.5 | | TIME | TIME |
| TIME | | | | 13:55 | |
| DATE | | | | DATE | DATE |
| | | | | 9/29/94 | 9/29/94 |
| ELEVATION | | CASING DEPTH | | | |

| | | | |
|----------------------|--|--------------------|--|
| RIG | | SURFACE CONDITIONS | |
| BEARING | | | |
| SAMPLE HAMMER TORQUE | | FT.-LBS | |

| BLOWS/AN OR SAMPLER (RECOVERY) | RUN NO. | CORES | | SOL DESCRIPTION OR ROCK LITHOLOGY | SYMBOL | ROCK STRUCTURE | SAMPLER AND BIT | CASING TYPE | BLOWS/FOOT ON CASING | TEST RESULTS | | |
|--------------------------------------|---------|-----------------------------------|------------|---|--------|--|-----------------|-------------|-------------------------|---------------------|----|--------------------------|
| | | NO. AND SIZE OF CORE PIECES | % RECOVERY | | | | | | | DEPTH IN FEET | | PERMEABILITY CM./SEC. |
| | | | | | | | | | | FROM | TO | |
| | | | | 6" Gravel SAND - f-mgr | | orange-brn | | | | | | |
| | | | | SAND, f-mgr orange-tan, Fe stain, moist | | | | | | | | |
| | | | | SAND 9' Fastain 9.5 SAND, fgr & silt SAND md brn 11' m-cgr 1" silt @ 11' | | Wet @ 9-9.5 brn - orange brn no odor | | | | | | |
| | | | | SAND f-mgr md brn wet no odor | | TD=15' | | | | | | |

CTI
DRILLING CONTR

RL

LOGGED BY JFH
DATE 9/29/94 CHK'D BY

Figure A.1
Geologic Boring Log

BOREHOLE LOG

| | | | | | |
|--|--|-------------------------------------|--|-------------------------------|--|
| SITE NAME AND LOCATION Jurtsmith AFB BT 45 | | DRILLING METHOD: HSA | | BORING NO. MW90745 | |
| 1. of bldg 5608 | | SAMPLING METHOD: Split Spoon | | SHEET 1 OF 1 | |
| | | DRILLING | | START TIME 0910 | |
| ELEVATION | | WATER LEVEL 9.5 | | FINISH TIME 10:00 | |
| DATE | | DATE | | DATE | |
| CASING DEPTH | | DATE | | DATE | |

| | | | |
|------------------------------------|--|-----------------------|--|
| SURFACE CONDITIONS | | TEST RESULTS | |
| BEARING | | DEPTH 2 FEET | |
| HAMMER TORQUE FT.-LBS | | PERMEABILITY CM./SEC. | |
| SOIL DESCRIPTION OR ROCK LITHOLOGY | | FROM TO | |

| BLOWS/AM ON SAMPLER (RECOVERY) | RUN NO. | NO. AND SIZE OF CORE PIECES | % RECOVERY | ROD | SOIL DESCRIPTION OR ROCK LITHOLOGY | SYMBOL | ROCK STRUCTURE | SAMPLER AND BIT | CASING TYPE | BLOWS/FOOT ON CASING | DEPTH 2 FEET | PERMEABILITY CM./SEC. |
|--------------------------------|---------|-----------------------------|------------|-----|---|--------|------------------------|-----------------|-------------|----------------------|--------------|-----------------------|
| | | | | | | | | | | | FROM | TO |
| | | | | | 6" Gravel Pavement SAND orange-br. SAND tan | | M-f gr moist | | | | | |
| | | | | | SAND f-m gr. lt | | orange-br, moist | | | | 5 | 7 3ppm 6 ppm |
| | | | | | SAND - 1" clor @ -9.5' | | no odr WL drilled 9.5' | | | | 8 | 10 4ppm |
| | | | | | SAND f-c gr. tan | | wet no odr | | | | 10 | 12 3ppm |
| | | | | | SAND f-m gr | | TD=15' | | | | 13 | 15 |

DRILLING CONTR **CTI**

RL

LOGGED BY **JFH**

DATE **9/29/94** CHK'D BY

Figure A.1
Geologic Boring Log

BOREHOLE LOG

NAME AND LOCATION

Wurtsmith
OT-45

DRILLING METHOD: Hollow Stem

BORING NO.

MU1010 D

Auger

SHEET

SAMPLING METHOD: 2-inch

1 OF 2

Split Spoon

DRILLING

START

FINISH

WATER LEVEL

TIME

DATE

CASING DEPTH

TIME

TIME

DATE

DATE

10-3-96

ELEVATION

RIG Acker Drill Max

SURFACE CONDITIONS

BEARING

HAMMER TORQUE

FT.-LBS

BLOWS/ AN
ON SAMPLER
(RECOVERY)

RUN NO.

NO. AND SIZE
OF
CORE PIECES

% RECOVERY

ROD

ROD

SOIL DESCRIPTION
OR
ROCK LITHOLOGY

SYMBOL

ROCK
STRUCTURE

SAMPLER AND BIT

CASING TYPE

BLOWS/FOOT
ON CASING

TEST RESULTS

DEPTH
IN
FEET

FROM

TO

PERMEABILITY
CM./SEC.

DRILLING CONTR

RL

LOGGED BY N. Marcelletti

DATE 10/3/96 CHK'D BY

Figure A.1
Geologic Boring Log

BOREHOLE LOG

NAME AND LOCATION

DRILLING METHOD:

BORING NO.

Hollow Stem Auger

MW0100

SAMPLING METHOD: 2-inch Split
- Spoon

SHEET
2 of 3
DRILLING

WATER LEVEL

START

FINISH

TIME

TIME

TIME

DATE

DATE

DATE

CASING DEPTH

ELEVATION

RIG

SURFACE CONDITIONS

BEARING

LE HAMMER TORQUE

FT.-LBS

| BLOWS/ FEET ON SAMPLER (RECOVERY) | RUN NO. | CORES | | | ROD | SOIL DESCRIPTION OR ROCK LITHOLOGY | SYMBOL | ROCK STRUCTURE | SAMPLER AND BIT | CASING TYPE | BLOWS/FOOT ON CASING | TEST RESULTS | | | |
|---|---------|-----------------------------------|------------|-----|-----|--|--|-------------------|-----------------|-------------|-------------------------|------------------|----|--------------------------|--|
| | | NO. AND SIZE OF CORE PIECES | % RECOVERY | ROD | | | | | | | | DEPTH IN FEET | | PERMEABILITY CM./SEC. | |
| | | | | | | | | | | | | FROM | TO | | |
| 7 14 18 23 | 3 | 1 | 66 | 20 | | | Same as above | | | | | | | | |
| 21 18 23 30 | 4 | 1 | 100 | 29 | | | Sand Med-coarse trace fine gravel Wet Yellowish Brown 10YR 5/4 Very Dense | | | | | | | | |

DRILLING CONTR

RL

LOGGED BY

DATE CHK'D BY

Figure A.1
Geologic Boring Log

BOREHOLE LOG

NAME AND LOCATION

Wurtsmith
OT-45

DRILLING METHOD:

Hollow Stem

BORING NO.

MW01010

SHEET

3 of 6

SAMPLING METHOD:

2-inch Split

Spcon

DRILLING

START

FINISH

WATER LEVEL

TIME

TIME

TIME

11:30

DATE

DATE

DATE

CASING DEPTH

10-5-94

ELEVATION

SURFACE CONDITIONS

BEARING

LE HAMMER TORQUE

FT.-LBS

BLOWS/IN.
ON SAMPLER
(RECOVERY)

RUN NO.

CORES

NO. AND SIZE
OF
CORE PIECES

% RECOVERY

ROD

SOL DESCRIPTION
OR
ROCK LITHOLOGY

SYMBOL

ROCK
STRUCTURE

SAMPLER AND BIT

CASING TYPE

BLOWS/FOOT
ON CASING

TEST RESULTS

DEPTH
IN
FEET

FROM

TO

PERMEABILITY
CM./SEC.

DRILLING CONTR

No Recovery

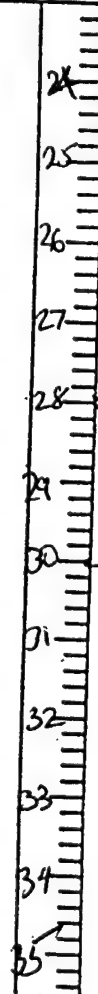


Figure A.1
Geologic Boring Log

LOGGED BY

DATE

CHK'D BY

RL

BOREHOLE LOG

NAME AND LOCATION

Wurtsmith
OT-45

DRILLING METHOD:

Hollow Stem

BORING NO.

MW010D

Auger

SHEET

4 of 7

SAMPLING METHOD:

2-inch Split

Spoon

DRILLING

WATER LEVEL

START

FINISH

TIME

TIME

TIME

DATE

7:50

DATE

DATE

CASING DEPTH

10-5-94

ELEVATION

SURFACE CONDITIONS

RIG

BEARING

LE HAMMER TORQUE

FT.-LBS

BLOWS/AN
ON SAMPLER
(RECOVERY)

CORES

RUN NO.

NO. AND SIZE
OF
CORE PIECES

% RECOVERY

ROD/RETR

SOL DESCRIPTION
OR
ROCK LITHOLOGY

SYMBOL

ROCK
STRUCTURE

SAMPLER AND BIT

CASING TYPE

BLOWS/FOOT
ON CASING

TEST RESULTS

DEPTH
IN
FEET

FROM

TO

PERMEABILITY
CM./SEC.

DRILLING CONTR

8
12
12
20

6

1

18

25

Sand fine-med
Light yellowish Brown Wet
10 YR 6/4 Dense

36

37

38

39

40

41

42

43

44

45

46

47

LOGGED BY

DATE CHK'D BY

RL

Figure A.1
Geologic Boring Log

BOREHOLE LOG

NAME AND LOCATION

Wutsmith
OT-45

DILLING METHOD: Hollow Stem

Auger

BORING NO.

MU0010 D

SHEET

5 of 6

SAMPLING METHOD: 2-luck

split Spoon

DILLING

START

FINISH

TIME
11:50

TIME

DATE

DATE

10-590

ELEVATION

CASING DEPTH

RIG SURFACE CONDITIONS

E BEARING

LE HAMMER TORQUE

FT.-LBS

| BLOWS/BL ON SAMPLER (RECOVERY) | CORES | | | | SOL DESCRIPTION OR ROCK LITHOLOGY | SYMBOL | ROCK STRUCTURE | SAMPLER AND BIT | CASING TYPE | BLOWS/FOOT ON CASING | TEST RESULTS | | |
|--------------------------------|---------|-----------------------------|------------|---------|-----------------------------------|--------|----------------|-----------------|-------------|----------------------|---------------|----|-----------------------|
| | RUN NO. | NO. AND SIZE OF CORE PIECES | % RECOVERY | ROD / P | | | | | | | DEPTH IN FEET | | PERMEABILITY CM./SEC. |
| | | | | | | | | | | | FROM | TO | |

14
13
13
19

1 100 6.8

Sand fine-med wet
same as above

48
49
50
51
52
53
54
55
56
57
58
59

8
12
15
21

8 1 60 1.2

Sand med
1-2 3/4 from bottom
Fine to med gravel wet
Light yellowish Brown
10496/4 dense

60 on next
Figure A.1 pag-
Geologic Boring Log

DRILLING CONTR

LOGGED BY

RL

DATE CLK'D BY

BOREHOLE LOG

NAME AND LOCATION

Wartsmith
OT-45

DRILLING METHOD:

BORING NO.

MW0106

SHEET

6 OF 6

SAMPLING METHOD:

DRILLING

WATER LEVEL

START

FINISH

TIME

TIME

TIME

DATE

DATE

DATE

CASING DEPTH

ELEVATION

SURFACE CONDITIONS

BEARING

LE HAMMER TORQUE

FT.-LBS

BLOWS/AM
ON SAMPLER
(RECOVERY)

CORES

RUN NO.

NO. AND SIZE
OF
CORE PIECES

% RECOVERY

ROD

SOL DESCRIPTION
OR
ROCK LITHOLOGY

SYMBOL

ROCK
STRUCTURE

SAMPLER AND BIT

CASING TYPE

BLOWS/FOOT
ON CASING

TEST RESULTS

DEPTH
IN
FEET

PERMEABILITY
CM./SEC.

FROM

TO

DRILLING CONTR

RL

LOGGED BY

DATE _____ CHK'D BY _____

Figure A.1
Geologic Boring Log

BOREHOLE LOG

| | | | | | | | |
|--|--|--|--|--|--|--------------------------|--|
| SITE NAME AND LOCATION Wurtsmith OT-45 MW010-OT45 | | DRILLING METHOD: <u>Hollow Stem</u> <u>Auger</u> | | | | BORING NO. MW010-OT45 | |
| | | SAMPLING METHOD: <u>2-inch Split</u> <u>Spoon</u> | | | | SHEET 1 OF 2 | |
| | | WATER LEVEL <u>9 ft</u> | | | | START TIME 12:55 | |
| | | TIME <u>1:11</u> | | | | FINISH TIME 12:55 | |
| DATE <u>10-3-94</u> | | DATE <u>10-3-94</u> | | | | DATE | |
| ELEVATION | | CASING DEPTH <u>20 ft</u> | | | | DATE | |

| | | | |
|---------------------------|--|--------------------------------------|--|
| RIG <u>Acker Soil Max</u> | | SURFACE CONDITIONS <u>Leve Paved</u> | |
| BEARING <u>0</u> | | SAMPLE HAMMER TORQUE FT.-LBS | |

| BLOWS/AM ON SAMPLER (RECOVERY) | CORES | | | | ROD/PI | SOIL DESCRIPTION OR ROCK LITHOLOGY | SYMBOL | ROCK STRUCTURE | SAMPLER AND BIT | CASING TYPE | BLOWS/FOOT ON CASING | TEST RESULTS | | |
|--------------------------------|---------|-----------------------------|------------|---------------|--------|------------------------------------|--------|----------------|-----------------|-------------|----------------------|-----------------------|------|----|
| | RUN NO. | NO. AND SIZE OF CORE PIECES | % RECOVERY | DEPTH IN FEET | | | | | | | | PERMEABILITY CM./SEC. | | |
| | | | | | | | | | | | | | FROM | TO |

| | | | | | | | | | | | | | | |
|-------------------|---|-----------|----|-----|---|--|--|--|--|--|--|--|--|--|
| 11 6 9 9 | 1 | 4 in | 20 | 6.0 | sand fine dry Very Pale Brown 10YR 7/3 | | | | | | | | | |
| 5 5 9 11 | 2 | 1 8 in | 40 | 2.0 | sand med wet Yellowish Brown 10YR 5/4 | | | | | | | | | |

Figure A.1
Geologic Boring Log

DRILLING CONTR

LOGGED BY Don Maxwell
 DATE 10-3-94 CHK'D BY RL

BOREHOLE LOG

| | | | | | | |
|--|-------------------------------------|------------|--|----------------|------------------------------|--------|
| SITE NAME AND LOCATION Wurtsmith AFB OT-45 MW010-OT45 | DRILLING METHOD: <u>Hollow Stem</u> | | | | BORING NO. <u>MW010-OT45</u> | |
| | <u>Auger</u> | | | | SHEET <u>2 of 2</u> | |
| | SAMPLING METHOD: <u>2-inch</u> | | | | DRILLING | |
| | <u>Split Spoon</u> | | | | START | FINISH |
| | WATER LEVEL | <u>9ft</u> | | | TIME | TIME |
| TIME | <u>1:11</u> | | | <u>12:55</u> | | |
| DATE | <u>10-3-94</u> | | | DATE | DATE | |
| CASING DEPTH | | | | <u>10-3-94</u> | | |

| | | | |
|----------------------|------------------|---------------------------|---------------------------------------|
| DAWN | ELEVATION | RIG <u>Acker Soil Max</u> | SURFACE CONDITIONS <u>Level Paved</u> |
| ANGLE <u>0</u> | BEARING <u>0</u> | | |
| SAMPLE HAMMER TORQUE | | FT.-LBS | |

| DEPTH IN FEET | BLOWS/ AN ON SAMPLER (RECOVERY) | CORES | | | | SOIL DESCRIPTION OR ROCK LITHOLOGY | SYMBOL | ROCK STRUCTURE | SAMPLER AND BIT | CASING TYPE | BLOWS/FOOT ON CASING | TEST RESULTS | | |
|---------------------|---------------------------------------|---------|-----------------------------------|------------|--|--|--------|-------------------|-----------------|-------------|-------------------------|---------------------|----|--------------------------|
| | | RUN NO. | NO. AND SIZE OF CORE PIECES | % RECOVERY | ROD/PTD | | | | | | | DEPTH IN FEET | | PERMEABILITY CM./SEC. |
| | | | | | | | | | | | | FROM | TO | |
| 7 8 14 23 | 3 | 1 12 | 60 | 2.0 | Sand Med Wet Yellowish Brown 104R 5/4 | | | | | | | | | |
| 2 18 23 30 | 4 | 1 24 | 100 | 2.0 | Sand med-coarse Trace fine gravel Wet Yellowish Brown 104R 5/4 | | | | | | | | | |
| | | | | | | | EO B | | | | | | | |

Figure A.1
Geologic Boring Log

DRILLING CONTR CTI

RL

LOGGED BY Dick Marcelle

DATE 10-3-94 CHK'D BY

Figure A.1
Geologic Boring Log

BOREHOLE LOG

| | | | | | |
|--|--|------------------------------|---|--------------------------|---------|
| SITE NAME AND LOCATION T45 Wurtsmith AFB | | DRILLING METHOD: HSA | | BORING NO. MW 10-OT45 | |
| | | | | SHEET 1 OF 1 | |
| | | SAMPLING METHOD: Split spoon | | | |
| | | | | DRILLING | |
| | | | | START | FINISH |
| | | WATER LEVEL | 9 | TIME | TIME |
| | | TIME | | | |
| | | DATE | | DATE | DATE |
| | | CASING DEPTH | | 10/6/94 | 10/6/94 |

| | | | |
|---------------|--|--------------------|--|
| ELEVATION | | SURFACE CONDITIONS | |
| RIG | | | |
| BEARING | | | |
| HAMMER TORQUE | | FT.-LBS | |

| BLOWS/AN ON SAMPLER (RECOVERY) | CORES | | | | SOL DESCRIPTION OR ROCK LITHOLOGY | SYMBOL | ROCK STRUCTURE | SAMPLER AND BIT | CASING TYPE | BLOWS/FOOT ON CASING | TEST RESULTS | | |
|--------------------------------|---------|-----------------------------|------------|-----|-----------------------------------|--------|----------------|-----------------|-------------|----------------------|---------------|----|-----------------------|
| | RUN NO. | NO. AND SIZE OF CORE PIECES | % RECOVERY | ROD | | | | | | | DEPTH IN FEET | | PERMEABILITY CM./SEC. |
| | | | | | | | | | | | FROM | TO | |

| | | | | | | | | | | | | | |
|------|--|--|--|--|--|--|-------------------|--|--|--|----|----|----------|
| | | | | | SAND, f-m gr dk brn | | moist | | | | | | |
| 3455 | | | | | SAND, v-f, t SILT | | orange-tan, moist | | | | 5 | 7 | 2 ppm |
| 2222 | | | | | SAND, f-m gr, orange wet @ 8' festain 9.5' CLAY SILT | | -tan, v. moist | | | | 8 | 10 | 2 ppm |
| 2445 | | | | | SAND, f-c gr, lt | | brn, wet | | | | 10 | 12 | S1 2 ppm |
| 3669 | | | | | SAA | | WL drilled 9' | | | | 12 | 14 | S2 4 ppm |
| | | | | | | | TO=15' | | | | | | |

DRILLING CONTR CTI

RL

LOGGED BY JFH
DATE 10/6/94 CHK'D BY

Figure A.1
Geologic Boring Log

water blank 8 ppm

BOREHOLE LOG

| | | | | | | |
|---|-------------------------------|-----|--|-----------------|------------------------|--------|
| SITE NAME AND LOCATION UW1-0T45 Nurtsmith AFB | DRILLING METHOD: HSA | | | | BORING NO. UW1-0T45 | |
| | | | | | SHEET 1 OF 1 | |
| | SAMPLING METHOD: Spl: + Spoon | | | | | |
| | | | | | DRILLING | |
| | | | | | START | FINISH |
| | WATER LEVEL | 9.5 | | | TIME | TIME |
| TIME | | | | 0910 | | |
| DATE | | | | DATE | | |
| | | | | 9/28/94 9/28/94 | | |
| CASING DEPTH | | | | | | |

| | | | |
|----------------------|--|--------------------|--|
| ELEVATION | | SURFACE CONDITIONS | |
| BEARING | | | |
| SAMPLE HAMMER TORQUE | | FT.-LBS | |

| BLOWS/ AN ON SAMPLER (RECOVERY) | RUN NO. | CORES | | | SOL DESCRIPTION OR ROCK LITHOLOGY | SYMBOL | ROCK STRUCTURE | SAMPLER AND BIT | CASING TYPE | BLOWS/FOOT ON CASING | TEST RESULTS | | |
|---------------------------------|---------|-----------------------------|------------|-----|-----------------------------------|--------|----------------|-----------------|-------------|----------------------|---------------|----|-----------------------|
| | | NO. AND SIZE OF CORE PIECES | % RECOVERY | ROD | | | | | | | DEPTH IN FEET | | PERMEABILITY CM./SEC. |
| | | | | | | | | | | | FROM | TO | |

| | | | | | | | | | | | | | |
|------|--|--|--|--|---|--|-----------------|--|--|--|-----|-----|--------|
| | | | | | SAND, f-m gr upper 6" dk brn then tan, orange, moist no odor | | | | | | 3 | 8 | PI 0 |
| | | | | | | | | | | | 3 | 5 | 15 ppm |
| 6764 | | | | | SAND, md gr, lt brn to 9.5 then gray diesel odor. @ top of sat zone, 9.5 thin SILT layer Fe Stain | | WL drilled 9.5' | | | | 7.5 | 9.5 | 30 ppm |
| | | | | | | | | | | | | | |
| | | | | | SAND, lt brn, m gr, to VC. no odor | | | | | | 15 | 17 | |

Figure A.1
Geologic Boring Log

DRILLING CONTR C77

LOGGED BY JFH

RL

DATE 9/28/94 CHK'D BY

BOREHOLE LOG

| | | | | | | | | |
|------------------------------------|--|--|--|--|------------------------------|--|-------------------------|---------|
| NAME AND LOCATION Wurtsmith AFB | | | | | DRILLING METHOD: HSA | | BORING NO. MPA-OT 45 | |
| OT 45 | | | | | | | SHEET | |
| | | | | | SAMPLING METHOD: Split Spoon | | 1 OF 1 | |
| | | | | | | | DRILLING | |
| | | | | | | | START | FINISH |
| WATER LEVEL | | | | | | | TIME | TIME |
| TIME | | | | | | | 10:50 | |
| DATE | | | | | | | DATE | DATE |
| CASING DEPTH | | | | | | | 9/28/94 | 9/28/94 |

| | | |
|----------------------|--------------------|--|
| OF L RIG | SURFACE CONDITIONS | |
| ANGLE | BEARING | |
| SAMPLE HAMMER TORQUE | FT.-LBS | |

| DEPTH FEET | BLOWS/ AN ON SAMPLER (RECOVERY) | | | | | CORES | SOIL DESCRIPTION OR ROCK LITHOLOGY | SYMBOL | ROCK STRUCTURE | SAMPLER AND BIT | CASINO TYPE | BLOWS/FOOT ON CASINO | TEST RESULTS | | |
|---------------|---------------------------------------|-----------------------------------|------------|-----|--------------------|-------|--|--------|-------------------|-----------------|-------------|-------------------------|--------------------------|------|----|
| | RUN NO. | NO. AND SIZE OF CORE PIECES | % RECOVERY | ROD | DEPTH 2 FEET | | | | | | | | PERMEABILITY CM./SEC. | | |
| | | | | | | | | | | | | | | FROM | TO |
| 1 | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | |
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| 9 | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | |
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| 39 | | | | | | | | | | | | | | | |
| 40 | | | | | | | | | | | | | | | |
| 41 | | | | | | | | | | | | | | | |
| 42 | | | | | | | | | | | | | | | |
| 43 | | | | | | | | | | | | | | | |

Figure A.1 is a hand-drawn geologic boring log. The log is organized into several vertical columns. The leftmost column contains depth markers in feet, ranging from 0 to 20. The next column contains soil type abbreviations (SAND, SAA) and grain size descriptions (LT brn, fgr, M-gr, etc.). The rightmost column contains a vertical scale from 0 to 20 feet, with a horizontal line at 10 feet labeled '10 ft'. The log is divided into sections by horizontal lines, and the data is recorded in a structured manner.

| Depth (ft) | Soil Type / Grain Size | Notes |
|---------------|--|-------|
| 0 - 1.30 | SAND, LT brn, fgr. Moist | |
| 1.30 - 3.45 | SAA some Fe stain | |
| 3.45 - 4.22 | SAA - sl odor, f-m gr | |
| 4.22 - 4.72 | 9' SAA - gray, odor | |
| 4.72 - 5.37 | SAND, M-gr, gray | |
| 5.37 - 7.13 | fuel odor ~ 1/2" silt + @ ~ 11', Uf-gr @ 12' | |
| 7.13 - 7.21 | SAND, f-UC, tr f gravel | |
| 7.21 - 7.43 | fuel odor, lt brn + gray | |
| 7.43 - 7.93 | SAND, M-UC, lt brn | |
| 7.93 - 8.16 | SAA, f-c | |
| 8.16 - 8.59 | SAA | |
| 8.59 - 9.14 | SAA, 1/2" silt layer @ ~ 19' | |
| 9.14 - 10.00 | | |
| 10.00 - 11.00 | | |
| 11.00 - 12.00 | | |
| 12.00 - 13.00 | | |
| 13.00 - 14.00 | | |
| 14.00 - 15.00 | | |
| 15.00 - 16.00 | | |
| 16.00 - 17.00 | | |
| 17.00 - 18.00 | | |
| 18.00 - 19.00 | | |
| 19.00 - 20.00 | | |

Additional notes from the log:

- UL drilled 9-9.5
- TD = 20

DRILLING CONTRA

18

LOGGED BY JFH
DATE 9/28/94 CHK'D BY

Figure A.1
Geologic Boring Log

BOREHOLE LOG

| | | | | | | | |
|-------------------|--|------------------------------|-----|--|--|------------|---------|
| NAME AND LOCATION | | DRILLING METHOD: HSA | | | | BORING NO. | |
| Wurtsmith AFB | | 6 1/2" ID | | | | MPB-0T45 | |
| OT45 | | SAMPLING METHOD: Split Spoon | | | | SHEET | |
| | | | | | | 1 OF 1 | |
| | | | | | | DRILLING | |
| | | | | | | START | FINISH |
| | | WATER LEVEL | 9.5 | | | TIME | TIME |
| | | TIME | | | | 14:10 | 15:10 |
| | | DATE | | | | DATE | DATE |
| | | CASING DEPTH | | | | 9/28/94 | 9/28/94 |

| | | |
|----------------------|--------------------|--|
| DRILL RIG | SURFACE CONDITIONS | |
| ANVIL | BEARING | |
| SAMPLE HAMMER TORQUE | FT.-LBS | |

[illegible][illegible]
$$\frac{110}{100}$$

DRILLING CONTR

RL

LOGGED BY JFH

DATE 9/28/94 CHK'D BY CHAND

Figure A.1
Geologic Boring Log

LOCATION MAP

Wurtsmith AFB
OT45

ENGINEERING-SCIENCE, INC. WELL LOG

PAGE 1 OF 3

WELL NUMBER MW0100

LOCATION OT-45

DATE 10-5-94

WEATHER Sunny 60 °F

LOGGED BY D. Marcelle H.

DRILLED BY CTI

DRILLING METHOD Hollow Stem Auger

SAMPLING METHOD 2-inch split spoon

GRAVEL PACK

SEAL Grout/Bentonite

CASING TYPE Schedule 80 PVC 20

DIAMETER 10-inch LENGTH 20/59

HOLE DIA. 12 1/1

Schedule 40 PVC 59

DIAMETER 2-inch

LENGTH 10 ft

TOTAL DEPTH 70'

SCREEN TYPE Schedule 40 PVC SLOT

10-slot

DIAMETER 2-inch

LENGTH 10 ft

TOTAL DEPTH 70'

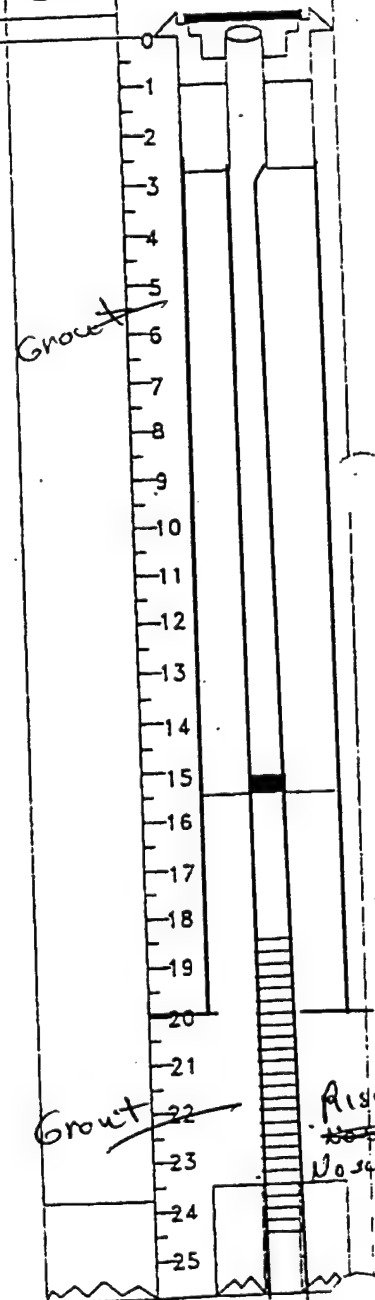
| SAMPLE NO. | ORGANIC VAPORS (PPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE |
|------------|----------------------|-------|-----------------|------------------------|
|------------|----------------------|-------|-----------------|------------------------|

LITHOLOGY/REMARKS
(COLOR, SOIL, TYPE, SORTING, MOISTURE, PLASTICITY)

LITHO. PROFILE

WELL COMPLETION

| | | | | |
|--|--|----|--|--|
| | | 0 | | |
| | | 1 | | |
| | | 2 | | |
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| | | 23 | | |
| | | 24 | | |
| | | 25 | | |

DATE: 10-5-94
DRAWN BY: [Signature]
UPDATE # 0

| | | | | |
|---------------------------|--|------------------------------------|--|-------------|
| LOCATION MAP | | ENGINEERING-SCIENCE, INC. WELL LOG | | PAGE 2 OF 3 |
| WELL NUMBER <u>MW0100</u> | | LOCATION <u>OT-45</u> | | |
| DATE | | WEATHER ° F | | |
| LOGGED BY | | DRILLED BY | | |
| DRILLING METHOD | | SAMPLING METHOD | | |
| GRAVEL PACK | | SEAL | | |

| CASING TYPE | | DIAMETER | | LENGTH | | HOLE DIA. | | |
|-------------|----------------------|----------|-----------------|------------------------|---|----------------|-------------|-----------------|
| SCREEN TYPE | | SLOT | | DIAMETER | | LENGTH | | |
| SAMPLE NO. | ORGANIC VAPORS (PPM) | DEPTH | SAMPLE RECOVERY | PENETRATION RESISTANCE | LITHOLOGY/REMARKS (COLOR, SOIL, TYPE, SORTING, MOISTURE, PLASTICITY) | LITHO. PROFILE | TOTAL DEPTH | WELL COMPLETION |
| | | | | | | | | |
| | | 25 | | | | | 25 | |
| | | 26 | | | | | 26 | |
| | | 27 | | | | | 27 | |
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| | | 46 | | | | | 46 | |
| | | 47 | | | | | 47 | |
| | | 48 | | | | | 48 | |
| | | 49 | | | | | 49 | |
| | | 50 | | | | | 50 | |

CLEVELAND 0004 DATE: DRAWN BY:

UPDATE # 0

← Gravel

← Riser No screen

LOCATION MAP

ENGINEERING-SCIENCE, INC. WELL LOG

PAGE 2 OF 3

WELL NUMBER MW00100

LOCATION OT-45

DATE

WEATHER

° F

LOGGED BY

DRILLED BY

DRILLING METHOD

SAMPLING METHOD

GRAVEL PACK

SEAL

CASING TYPE

DIAMETER

LENGTH

HOLE DIA.

SCREEN TYPE

SLOT

DIAMETER

LENGTH

TOTAL DEPTH

SAMPLE NO.

ORGANIC VAPORS (PPM)

DEPTH

SAMPLE RECOVERY

PENETRATION RESISTANCE

LITHOLOGY/REMARKS
(COLOR, SOIL, TYPE, SORTING, MOISTURE, PLASTICITY)

LITHO. PROFILE

WELL COMPLETION

25
26
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7-40
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50gravel
sand
pac

CITY

DATE

DRAWN BY

UPDATE # 0

FLUSH MOUNT RISER BOX

LOCKABLE CAP

GROUND SURFACE
(618.09' MSL)

TOC (617.94' MSL)

BENTONITE

2" DIA. SCH. 40 PVC
SURFACE CASING

9.0

10.0

15.0

15.0

SAND

2" DIA. SCH. 40 PVC SCREEN
W/THREADED JOINTS
SLOT SIZE = 0.010"

8" DIA. BOREHOLE

END CAP

**FLUSH-MOUNTED
MONITORING WELL DESIGN DETAIL
WELL NO. MW4-OT45**

SITE: OT45

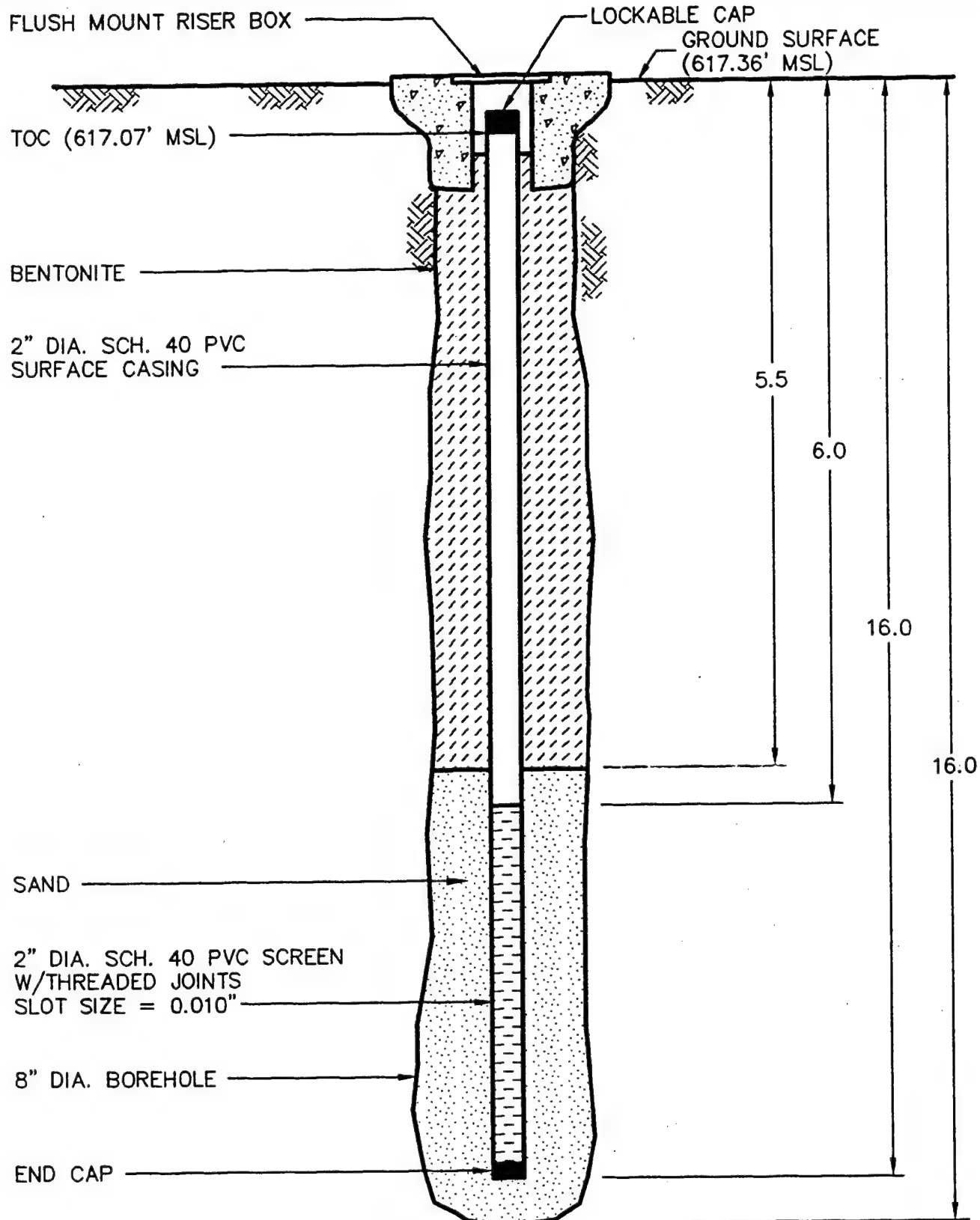
GEOLOGIST: JFH

DATE COMPLETED: 09/29/94

WURTSMITH AFB, MI



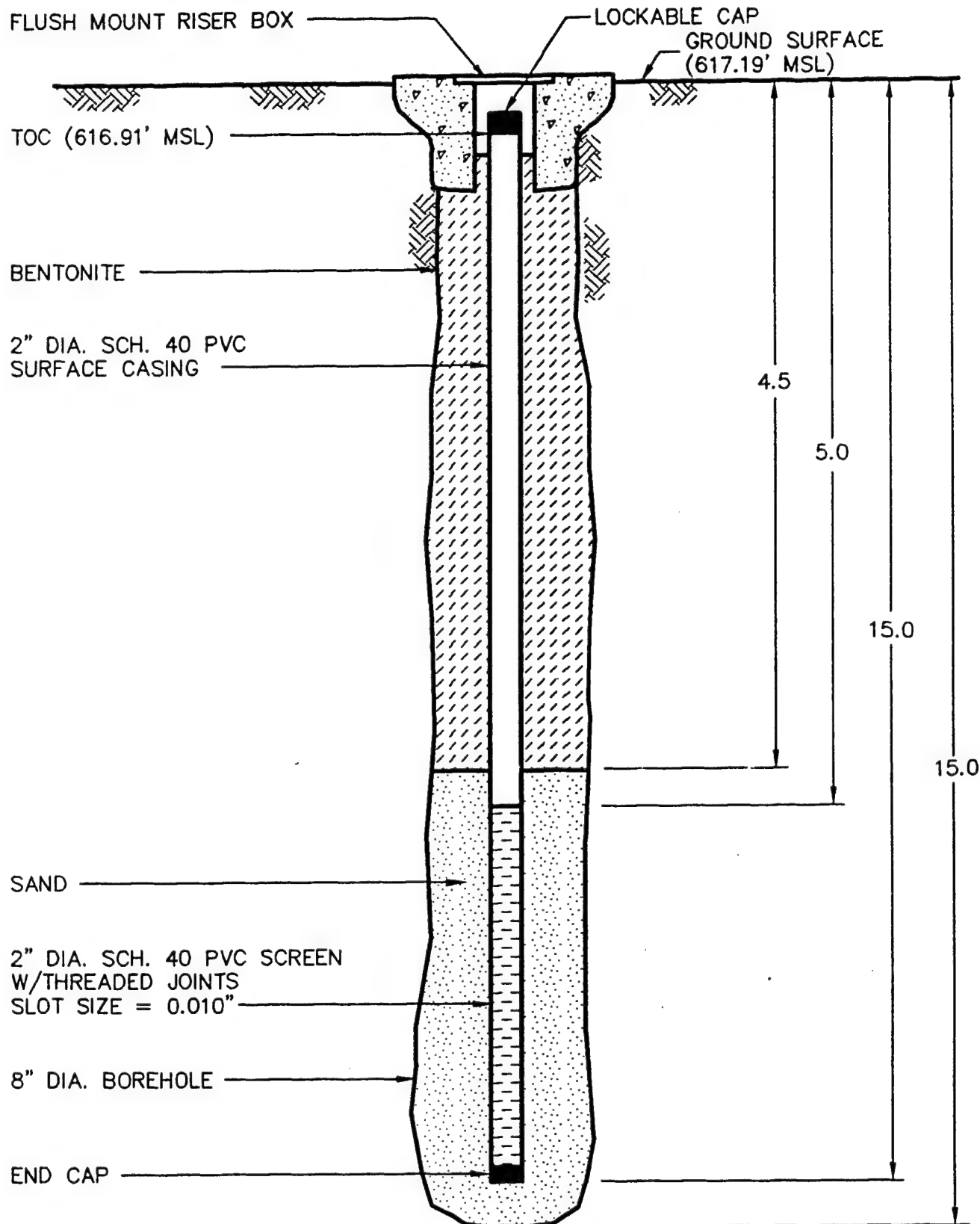
**PARSONS
ENGINEERING SCIENCE, INC.**



**FLUSH-MOUNTED
MONITORING WELL DESIGN DETAIL
WELL NO. MW5**

SITE: OT45
GEOLOGIST: JFH
DATE COMPLETED: 09/29/94
WURTSMITH AFB, MI

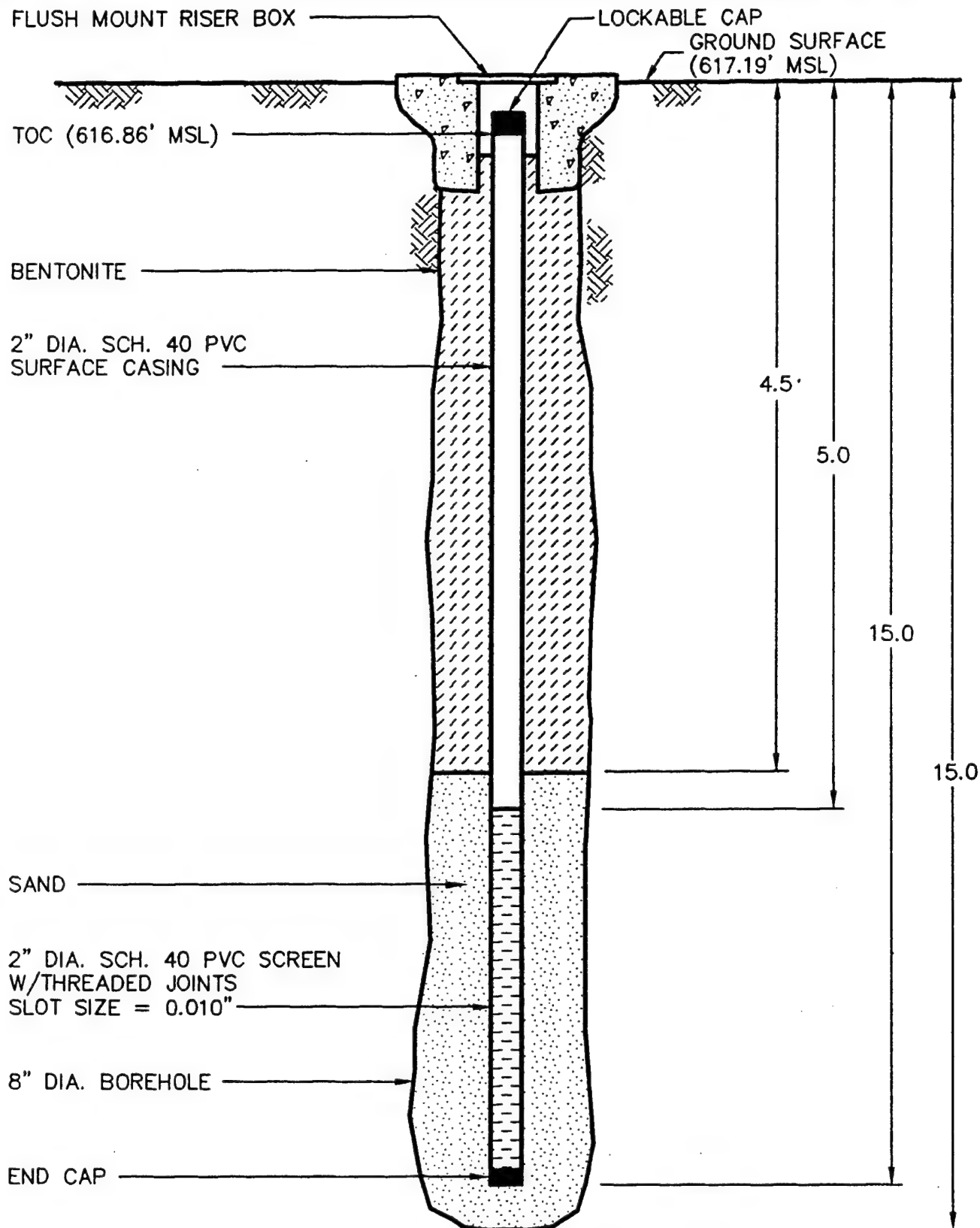
**PARSONS
ENGINEERING SCIENCE, INC.**



**FLUSH-MOUNTED
MONITORING WELL DESIGN DETAIL
WELL NO. MW6**

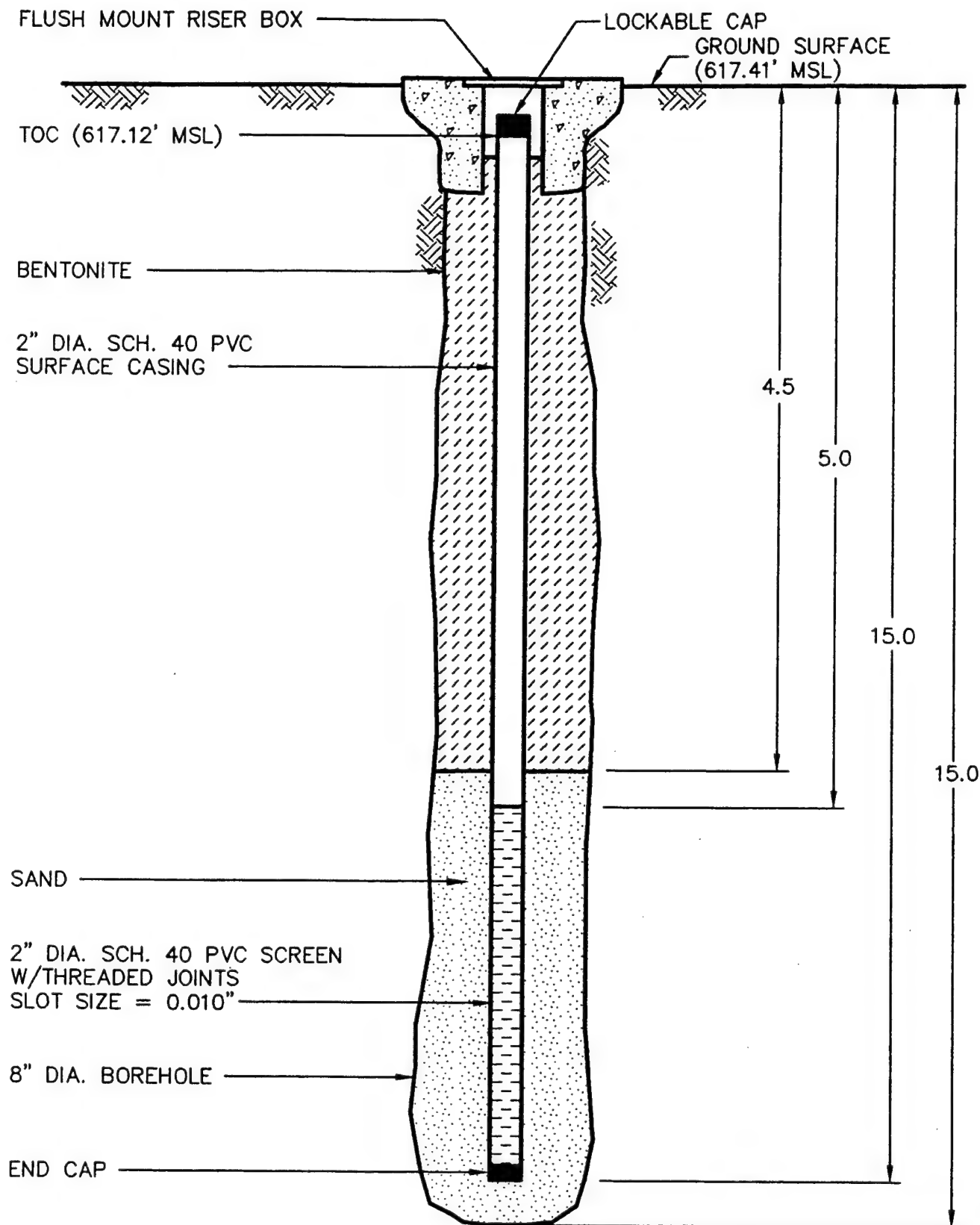
SITE: OT45
GEOLOGIST: JFH
DATE COMPLETED: 09/28/94
WURTSMITH AFB, MI

**PARSONS
ENGINEERING SCIENCE, INC.**



**FLUSH-MOUNTED
MONITORING WELL DESIGN DETAIL
WELL NO. MW7**

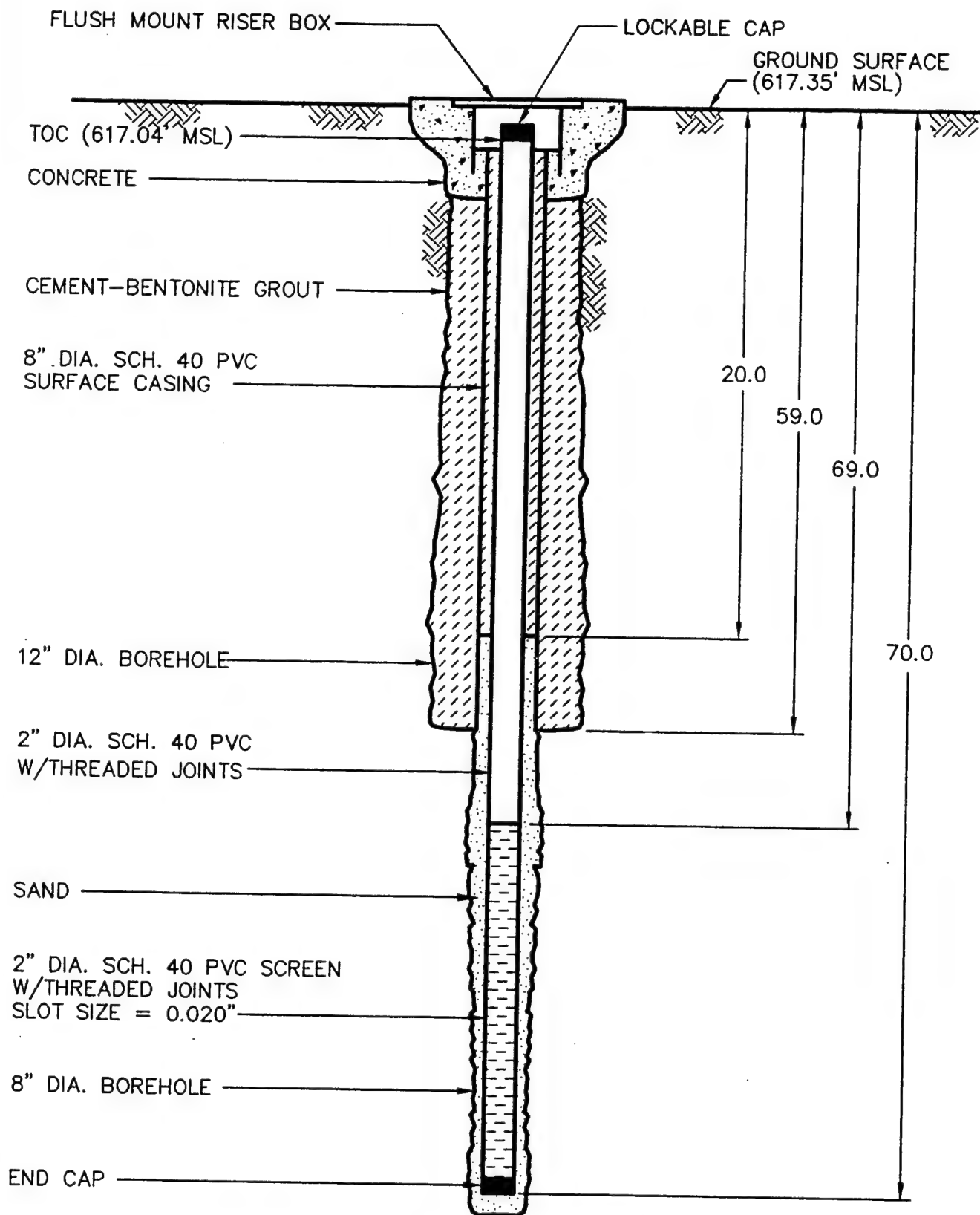
SITE: OT45
GEOLOGIST: JFH
DATE COMPLETED: 09/28/94
WURTSMITH AFB, MI



**FLUSH-MOUNTED
MONITORING WELL DESIGN DETAIL
WELL NO. MW9**

SITE: OT45
GEOLOGIST: JFH
DATE COMPLETED: 09/29/94
WURTSMITH AFB, MI

**PARSONS
ENGINEERING SCIENCE, INC.**



MONITORING WELL DESIGN DETAIL WELL NO. MW10

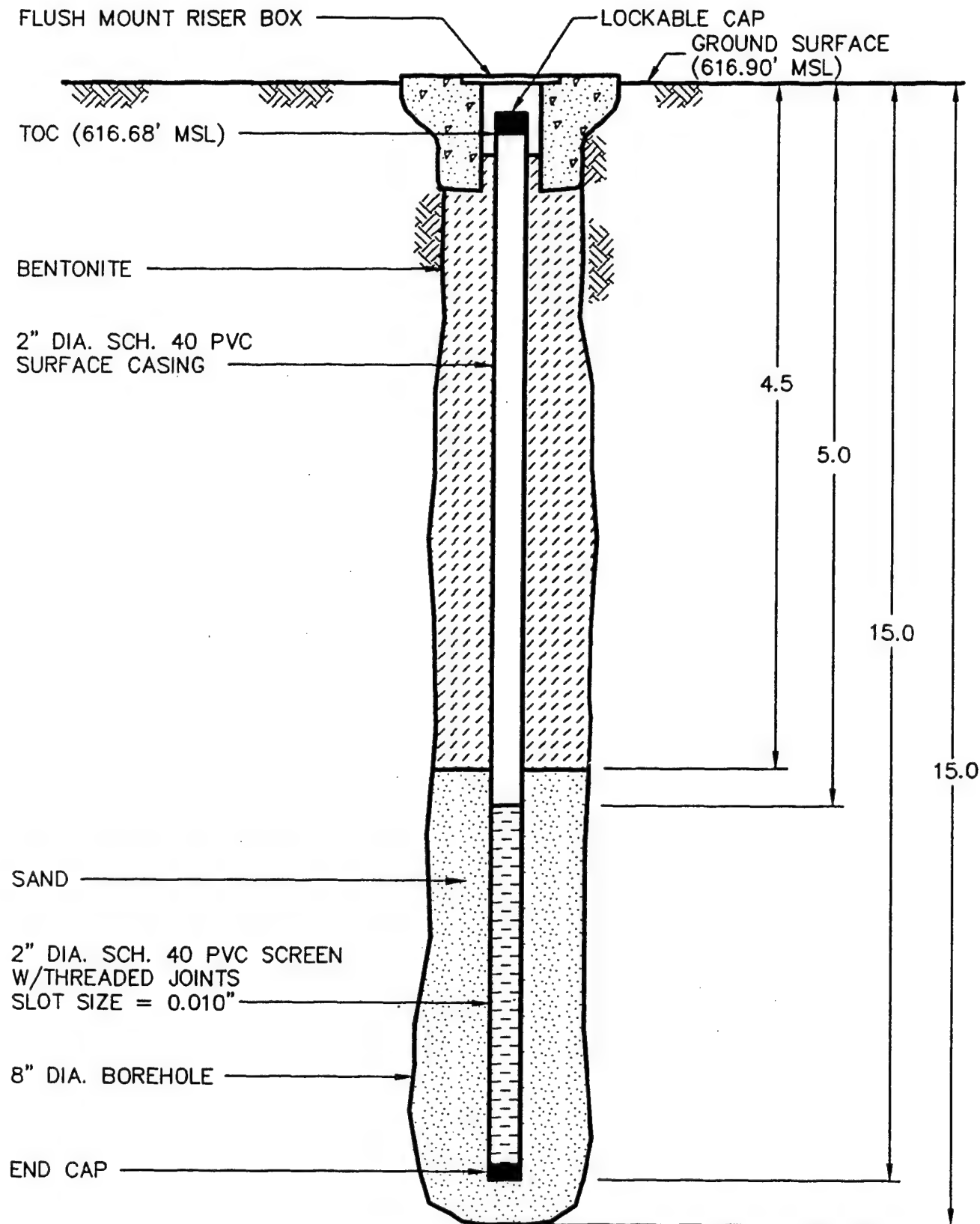
SITE: OT45

GEOLOGIST: NM

DATE COMPLETED: 10/05/94

WURTSMITH AFB, MI

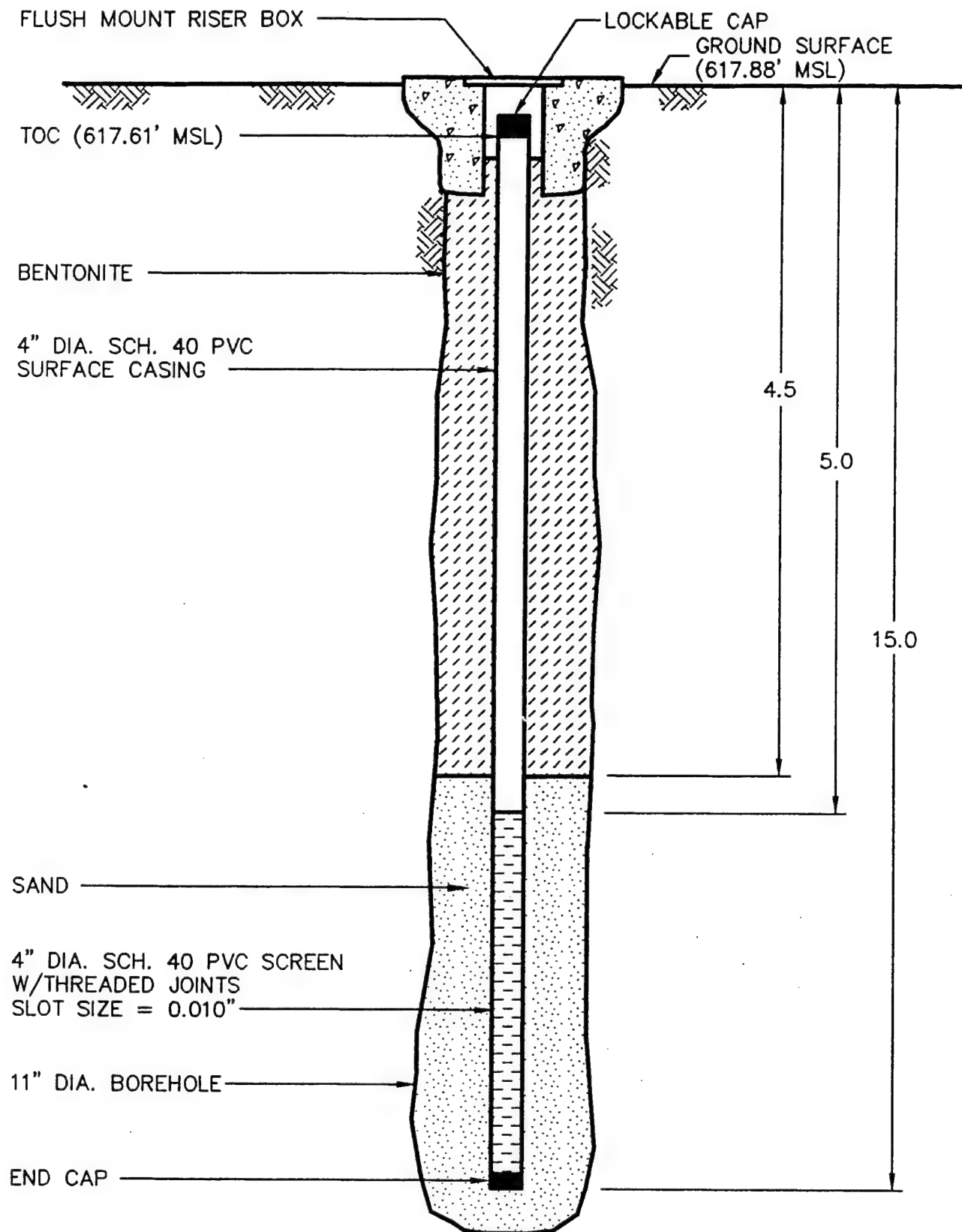
PARSONS
ENGINEERING SCIENCE, INC.



**FLUSH-MOUNTED
MONITORING WELL DESIGN DETAIL
WELL NO. MW11**

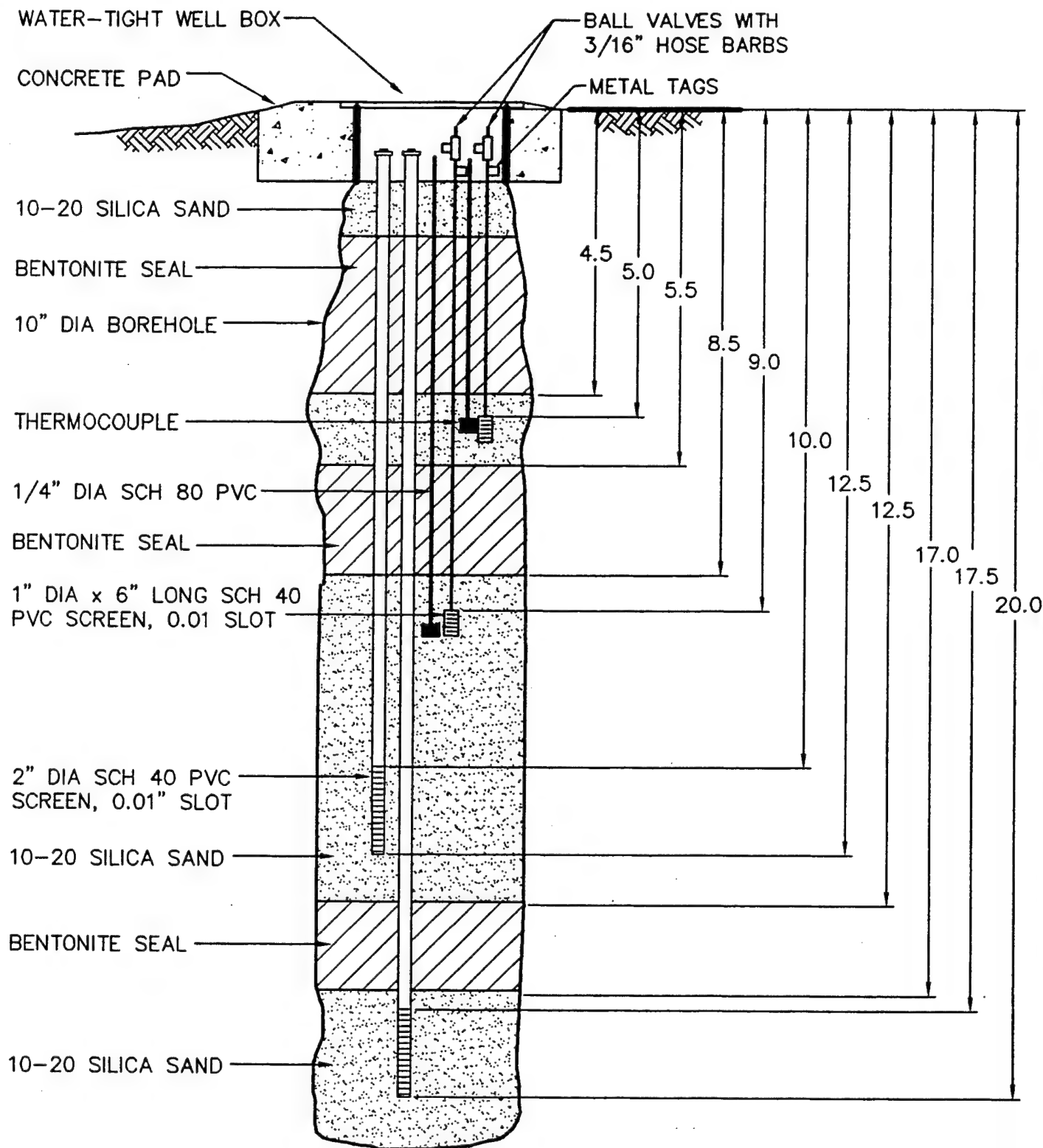
SITE: OT45
GEOLOGIST: JFH
DATE COMPLETED: 10/06/94
WURTSMITH AFB, MI

**PARSONS
ENGINEERING SCIENCE, INC.**



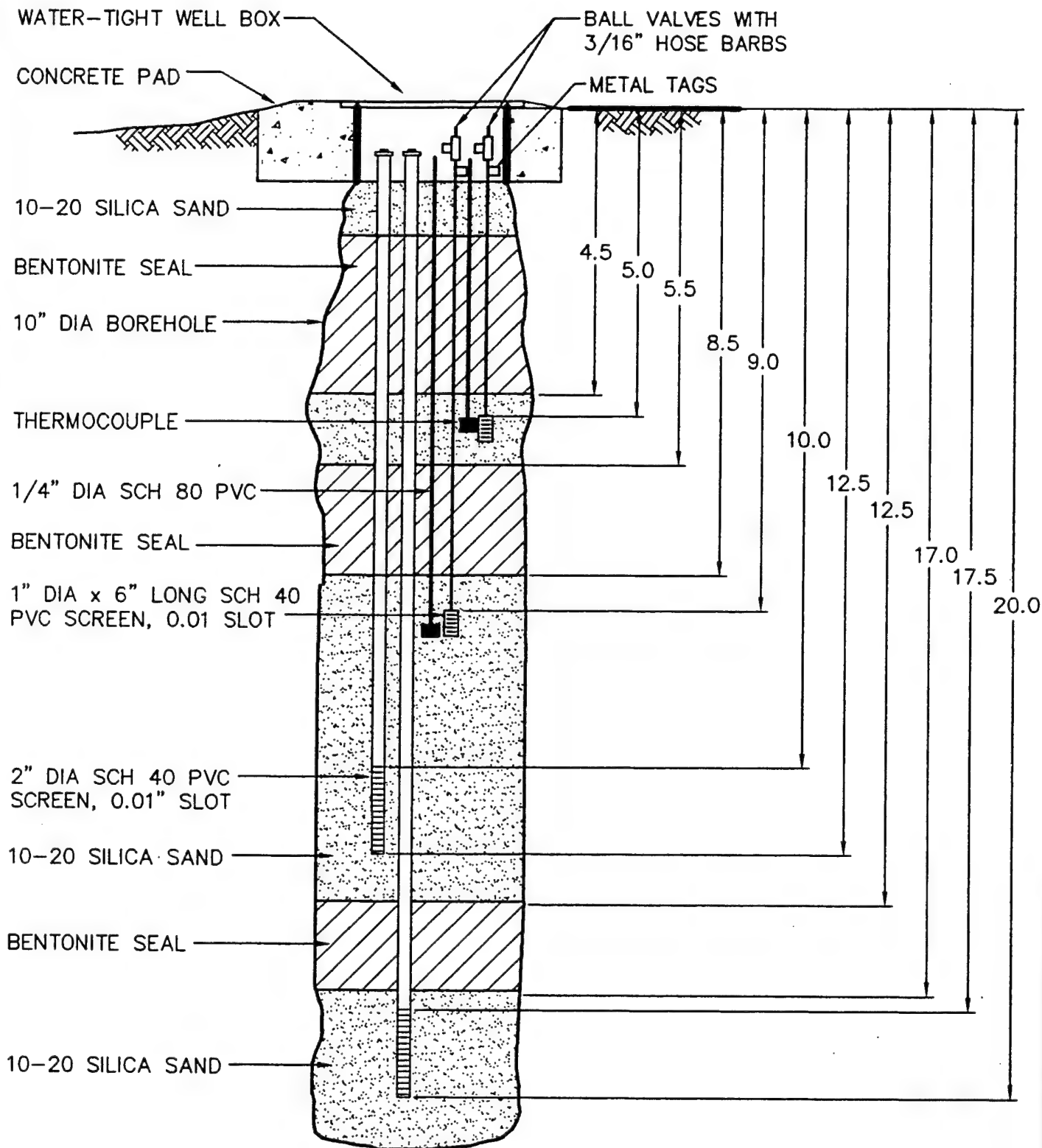
**FLUSH-MOUNTED
VENT WELL DESIGN DETAIL
WELL NO. VW-1**

SITE: OT45
GEOLOGIST: JFH
DATE COMPLETED: 09/28/94
WURTSMITH AFB, MI



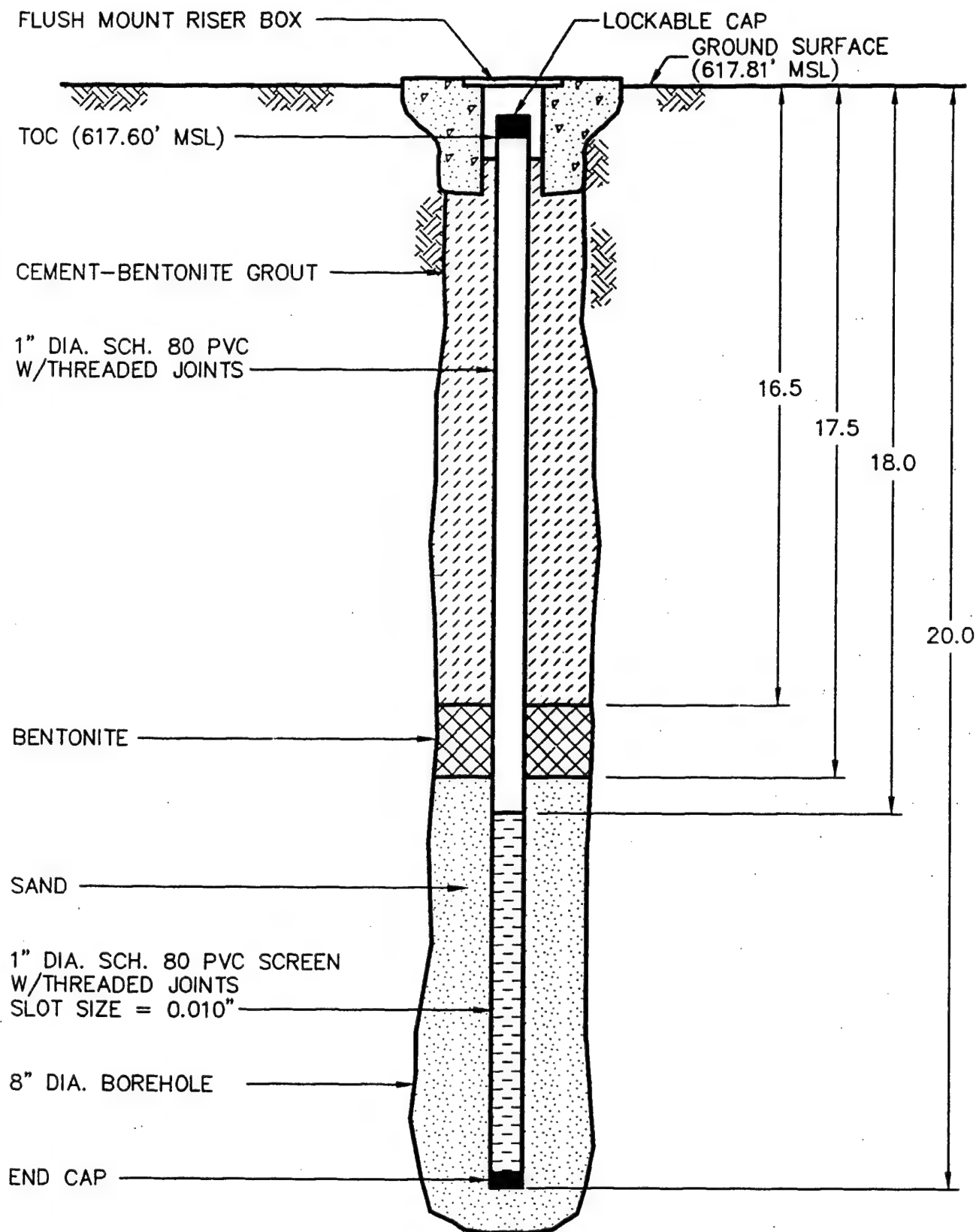
**MONITORING POINT
CONSTRUCTION DETAIL
WELL NO. MPA**

SITE: OT45
GEOLOGIST: JFH
DATE COMPLETED: 09/28/94
WURTSMITH AFB, MI



**MONITORING POINT
CONSTRUCTION DETAIL
WELL NO. MPB**

SITE: OT45
GEOLOGIST: JFH
DATE COMPLETED: 09/28/94
WURTSMITH AFB, MI



**FLUSH-MOUNTED
AIR SPARGING WELL DESIGN DETAIL
WELL NO. SP1**

SITE: OT45
GEOLOGIST: JFH
DATE COMPLETED: 10/04/94
WURTSMITH AFB, MI

**PARSONS
ENGINEERING SCIENCE, INC.**

WELL DEVELOPMENT RECORD

Well Designation VW1-0T45 Developed By J. Hall Date 9/30/94

Time Started 13:20 Time Ended 13:40

Development Method:

BAIL X PUMP X SURGE X AIR LIFT

OTHER (SPECIFY) _____

Casing Volume _____ Approximate Volume Removed _____

| TIME/ BAILER NO. | TEMPERATURE | pH | ELECTRICAL CONDUCTIVITY | TURBIDITY | HNU | VISUAL APPEARANCE |
|---------------------|-------------|------|----------------------------|-----------|-----|-------------------|
| (Start) | | | | | | |
| 2 gal | 62.8 | 7.22 | 348 | | | |
| 10 gal | 61.0 | 7.64 | 269 | | | |
| 20 | 57.8 | 7.66 | 255 | | | |
| 30 | 58.8 | 7.70 | 241 | | | |
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| (Finish) | | | | | | |

Comments:

Strong shear + diesel oil odor

WELL DEVELOPMENT RECORD

Well Designation MPA-UT45S Developed By J. Hall Date 9/30/94

Time Started 13:00 Time Ended 13:10

Development Method:

BAIL ✓ PUMP ✓ SURGE ✓ AIR LIFT

OTHER (SPECIFY) _____

Casing Volume _____ Approximate Volume Removed _____

| TIME/ BAILER NO. | TEMPERATURE | pH | ELECTRICAL CONDUCTIVITY | TURBIDITY | HNU | VISUAL APPEARANCE |
|---------------------|-------------|------|----------------------------|-----------|-----|-------------------|
| (Start) 2 gal | 68.0 | 7.70 | 380 | | | V. cloudy |
| 10 gal | 63.9 | 7.72 | 383 | | | |
| 12 gal | 62.5 | 7.84 | 393 | | | Slightly cloudy |
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| (Finish) | | | | | | |

Comments:

Sheen on water surface, diesel odor.

WELL DEVELOPMENT RECORD

Well Designation MPA-0745 D Developed By J. Hall Date 9/30/94

Time Started 13:10 Time Ended 13:20

Development Method:

BAIL + PUMP + SURGE + AIR LIFT +

OTHER (SPECIFY) _____

Casing Volume _____ Approximate Volume Removed _____

| TIME/ BAILER NO. | TEMPERATURE | pH | ELECTRICAL CONDUCTIVITY | TURBIDITY | HNU | VISUAL APPEARANCE |
|---------------------|-------------|------|----------------------------|-----------|-----|-------------------|
| (Start) 2 gal | 61.0 | 8.10 | 200 | | | |
| 10 gal | 57.0 | 8.17 | 170 | | | |
| 15 gal | 55.8 | 8.21 | 168 | | | |
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| (Finish) | | | | | | |

Comments:

no noticeable stain or odor

WELL DEVELOPMENT RECORD

Well Designation MPB-OT45 S Developed By J. Hall Date 9/30/94

Time Started 11:30 Time Ended 12:00

Development Method:

BAIL _____ PUMP _____ SURGE _____ AIR LIFT _____

OTHER (SPECIFY) _____

Casing Volume _____ Approximate Volume Removed _____

| TIME/ BAILER NO. | TEMPERATURE | pH | ELECTRICAL CONDUCTIVITY | TURBIDITY | HNU | VISUAL APPEARANCE |
|---------------------|-------------|-------|----------------------------|-----------|-----|-------------------|
| (Start) | | | | | | |
| 2 gal | 64.0 | 6.80 | 330 | | | |
| 10 | 60.9 | 6.30 | 452 | | | |
| | | 7.09* | 41 | | | |
| 20 | 59.6 | 7.50 | 418 | | | |
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| (Finish) | | | | | | |

Comments:

Comments: Sheen on water ^{diesel} oil odor
* re-calibrated pH meter

WELL DEVELOPMENT RECORD

Well Designation MPB-0745 D Developed By _____ Date 7/31/98

Time Started 12:00 Time Ended 12:20

Development Method:

BAIL + PUMP + SURGE 1 AIR LIFT

OTHER (SPECIFY) _____

Casing Volume _____ Approximate Volume Removed _____

| TIME/ BAILER NO. | TEMPERATURE | pH | ELECTRICAL CONDUCTIVITY | TURBIDITY | HNU | VISUAL APPEARANCE |
|---------------------|-------------|------|----------------------------|-----------|-----|-------------------|
| (Start) | | | | | | |
| 250' | 59.6 | 7.25 | 248 | | | cloudy |
| 40 | 61.0 | 7.75 | 235 | | | clear |
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| (Finish) | | | | | | |

Comments:

re-calibrated pH meter,
no shown

9/29/94

Date 9/30/48

Time Ended 09:45

TOC

BAIL + PUMP + SURGE + AIR LIFT

OTHER (SPECIFY) 04:28

Casing Volume _____ Approximate Volume Removed _____

(Finish)

Comments:

WELL DEVELOPMENT RECORD

Well Designation MW5-0745 Developed By J. Hall Date 9/30/94

Time Started 10:50 Time Ended 11:20

WL 9.63 TD 15.70 TUC

Development Method:

BAIL 2 PUMP 2 SURGE 2 AIR LIFT

OTHER (SPECIFY) _____

Casing Volume _____ Approximate Volume Removed _____

| TIME/ BAILER NO. | TEMPERATURE | pH | ELECTRICAL CONDUCTIVITY | TURBIDITY | HNU | VISUAL APPEARANCE |
|---------------------|-------------|------|----------------------------|-----------|-----|-------------------|
| (Start) | | | | | | |
| 5 gal | 54.9 | 7.39 | 270 | | | V-Cloudy |
| 30 | 50.8 | 7.15 | 260 | | | s/c cloudy |
| 45 | 54.6 | 6.95 | 268 | | | s/c cloudy |
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| (Finish) | | | | | | |

Comments:

oil on water
film

WELL DEVELOPMENT RECORD

Well Designation MW6 Developed By JFH/11 Date 9/30/94

Time Started 0840 Time Ended 09:10
WL 9.73 TD 14.60 Tac

Development Method:

BAIL X PUMP X SURGE _____ AIR LIFT _____

OTHER (SPECIFY) _____

Casing Volume _____ Approximate Volume Removed _____

| TIME/ BAILER NO. | TEMPERATURE | pH | ELECTRICAL CONDUCTIVITY | TURBIDITY | HNU | VISUAL APPEARANCE |
|---------------------|-------------|-------|----------------------------|-----------|-----|-------------------|
| (Start) 2 gal | 43 | 8.40 | 189 | | | Muddy |
| 18 | 49.2 | 8.96 | 106 | | | V. cloudy |
| 25 | 52.8 | 8.75 | 175 | | | cloudy |
| 37 | 53.7 | 7.40* | 179 | | | " |
| 45 | 54.2 | 7.28 | 173 | | | SI cloudy |
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| (Finish) | | | | | | |

Comments:

* re-calibrated pH - tends to increase w ↑ temp

Figure A.6
Well Development Record

Page 1 of 1

Job Number 725523
Location OT45
Well Number MW 8

Job Name W. J. Smith
By JFH Date 7/30/94
Measurement Datum TOC

Pre-Development Information

Time (Start):

Water Level: 9.87

Total Depth of Well: 14.45

Water Characteristics

Color _____ Clear _____ Cloudy _____
Odor: None _____ Weak _____ Moderate _____ Strong _____
Any Films or Immiscible Material _____
pH _____ Temperature (°F °C) _____
Specific Conductance (μS/cm) _____

Interim Water Characteristics

Gallons Removed

pH

Temperature (°F °C)

Specific Conductance (μS/cm)

Post-Development Information

Time (Finish):

Water Level:

Total Depth of Well:

Approximate Volume Removed:

Water Characteristics

Color _____ Clear _____ Cloudy _____
Odor: None _____ Weak _____ Moderate _____ Strong _____
Any Films or Immiscible Material _____
pH _____ Temperature (°F °C) _____
Specific Conductance (μS/cm) _____

Comments:

Well Designation MWB-0145 Developed By _____ Date 7/30/44

Development Method:

OTHER (SPECIFY) _____

| TIME/ BAILER NO. | TEMPERATURE | pH | ELECTRICAL CONDUCTIVITY | TURBIDITY | HNU | VISUAL APPEARANCE |
|---------------------|-------------|------|----------------------------|-----------|-----|-------------------|
| (Start) 2 gal | 41.5 | 7.13 | 300 | muddy | | Muddy, |
| -8 gal | 48.5 | 7.40 | 314 | | | " |
| 15 | 51.7 | 7.51 | 311 | | | sl cloudy, |
| 25 | 51.2 | 7.65 | 310 | | | |
| 30 | 51.6 | 7.63 | 310 | | | |
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| (Finish) | | | | | | |

Comments:

WELL DEVELOPMENT RECORD

Well Designation MW9-0745 Developed By J. Hall Date 9/30/44

Time Started 10:00

Time Ended 10:30

WL 9.70 TD 14.50

Development Method:

BAIL X PUMP X SURGE X AIR LIFT

OTHER (SPECIFY) _____

Casing Volume _____ Approximate Volume Removed _____

| TIME/ BAILER NO. | TEMPERATURE | pH | ELECTRICAL CONDUCTIVITY | TURBIDITY | HNU | VISUAL APPEARANCE |
|---------------------|-------------|------|----------------------------|-----------|-----|-------------------|
| (Start) 2 gal | 55.5 | 7.45 | 299 | | | Muddy |
| 10 | 55.9 | 7.67 | 285 | | | cloudy |
| 15 | 57.31 | 7.65 | 285 | | | |
| 25 | 57.8 | 7.74 | 283 | | | |
| 47 | 56.1 | 7.85 | 268 | | | |
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| (Finish) | | | | | | |

Comments:

Figure A.6
Well Development Record

Page of

Job Number
Location
Well Number MW11-0745

Job Name
By Date 10/6/94
Measurement Datum

Pre-Development Information

Time (Start): 11:50

Water Level: 9.87

Total Depth of Well: 14.55

Water Characteristics

Color brn Clear Cloudy
Odor: None Weak Moderate Strong
Any Films or Immiscible Material No
pH Temperature (°F °C)
Specific Conductance (µS/cm)

Interim Water Characteristics

| Gallons Removed | 5 | 20 | 30 | 35 |
|------------------------------|------|------|------|------|
| pH | 9.04 | 9.04 | 8.95 | 8.65 |
| Temperature (°F °C) | 58.4 | 58.1 | 57.2 | 56.9 |
| Specific Conductance (µS/cm) | 270 | 301 | 298 | 302 |

Post-Development Information

Time (Finish):

Water Level: 9.87

Total Depth of Well: 14.60

Approximate Volume Removed: 35 gal

Water Characteristics

Color brn sl cloudy Clear Cloudy
Odor: None Weak Moderate Strong
Any Films or Immiscible Material No
pH 8.65 Temperature (°F °C) 56.9
Specific Conductance (µS/cm) 302

Comments:

APPENDIX B
ANALYTICAL DATA

TABLE B.1
VALIDATED SOIL DATA FOR VOLATILE ORGANIC COMPOUNDS
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Sample Interval (ft bgs: begining-ending) | Analyte | Result | Units | Analytical Method |
|------------------|-------------|--|--------------------------------|---------------------|-------|-------------------|
| DC-OT45 (MW2) | 28-Sep-94 | 12.00 - 15.00 | Total Extractable Hydrocarbons | 550 J ^h | mg/kg | M8015 |
| | | | Benzene | 2.3 U ^h | µg/kg | SW8020 |
| | | | Toluene | 23 U | µg/kg | SW8020 |
| | | | Ethylbenzene | 6.9 J | µg/kg | SW8020 |
| | | | Xylenes (Total) | 30 | µg/kg | SW8020 |
| | | | 1,3,5-Trimethylbenzene | 160 | µg/kg | SW8020 |
| | | | 1,2,4-Trimethylbenzene | 240 | µg/kg | SW8020 |
| | | | 1,2,3-Trimethylbenzene | 240 | µg/kg | SW8020 |
| MPA-OT45 | 28-Sep-94 | 8.00 - 9.50 | Total Extractable Hydrocarbons | 100 UJ ^h | mg/kg | M8015 |
| | | | Benzene | 0.46 U | µg/kg | SW8020 |
| | | | Toluene | 0.5 J | µg/kg | SW8020 |
| | | | Ethylbenzene | 4.6 U | µg/kg | SW8020 |
| | | | Xylenes (Total) | 4.6 U | µg/kg | SW8020 |
| | | | 1,2,4-Trimethylbenzene | 4.6 U | µg/kg | SW8020 |
| | | | 1,2,3-Trimethylbenzene | 4.6 U | µg/kg | SW8020 |
| MPB-OT45 | 28-Sep-94 | 8.00 - 9.50 | Total Extractable Hydrocarbons | 12000 J | mg/kg | M8015 |
| | | | Benzene | 2.2 U | µg/kg | SW8020 |
| | | | Toluene | 22 U | µg/kg | SW8020 |
| | | | Ethylbenzene | 8.2 J | µg/kg | SW8020 |
| | | | Xylenes (Total) | 25 | µg/kg | SW8020 |
| | | | 1,3,5-Trimethylbenzene | 390 | µg/kg | SW8020 |
| | | | 1,2,4-Trimethylbenzene | 900 | µg/kg | SW8020 |
| | | | 1,2,3-Trimethylbenzene | 540 | µg/kg | SW8020 |
| MW4-OT45 | 29-Sep-94 | 8.00 - 9.50 | Benzene | 0.48 U | µg/kg | SW8020 |
| | | | Toluene | 4.8 U | µg/kg | SW8020 |
| | | | Ethylbenzene | 4.8 U | µg/kg | SW8020 |
| | | | Xylenes (Total) | 4.8 U | µg/kg | SW8020 |
| | | | 1,3,5-Trimethylbenzene | 4.8 U | µg/kg | SW8020 |
| | | | 1,2,4-Trimethylbenzene | 4.8 U | µg/kg | SW8020 |
| | | | 1,2,3-Trimethylbenzene | 4.8 U | µg/kg | SW8020 |
| MW5-OT45 | 29-Sep-94 | 10.00 - 13.00 | Benzene | 2.3 U | µg/kg | SW8020 |
| | | | Toluene | 31 | µg/kg | SW8020 |
| | | | Ethylbenzene | 160 | µg/kg | SW8020 |
| | | | Xylenes (Total) | 890 | µg/kg | SW8020 |
| | | | 1,3,5-Trimethylbenzene | 1300 J | µg/kg | SW8020 |
| | | | 1,2,4-Trimethylbenzene | 2200 J | µg/kg | SW8020 |
| | | | 1,2,3-Trimethylbenzene | 1400 J | µg/kg | SW8020 |
| MW6-OT45 | 29-Sep-94 | 8.00 - 9.50 | Benzene | 0.49 U | µg/kg | SW8020 |
| | | | Toluene | 4.9 U | µg/kg | SW8020 |
| | | | Ethylbenzene | 4.9 U | µg/kg | SW8020 |
| | | | Xylenes (Total) | 4.9 U | µg/kg | SW8020 |
| | | | 1,3,5-Trimethylbenzene | 4.9 U | µg/kg | SW8020 |
| | | | 1,2,4-Trimethylbenzene | 4.9 U | µg/kg | SW8020 |
| | | | 1,2,3-Trimethylbenzene | 4.9 U | µg/kg | SW8020 |
| MW7-OT45 | 27-Sep-94 | 8.00 - 9.00 | Total Extractable Hydrocarbons | 35 J | mg/kg | M8015 |
| | | | Benzene | 0.47 UJ | µg/kg | SW8020 |
| | | | Toluene | 4.7 UJ | µg/kg | SW8020 |
| | | | Ethylbenzene | 4.7 UJ | µg/kg | SW8020 |
| | | | Xylenes (Total) | 4.7 UJ | µg/kg | SW8020 |
| | | | 1,3,5-Trimethylbenzene | 0.9 J | µg/kg | SW8020 |
| | | | 1,2,4-Trimethylbenzene | 4.7 UJ | µg/kg | SW8020 |
| | | | 1,2,3-Trimethylbenzene | 4.7 UJ | µg/kg | SW8020 |
| MW8-OT45 | 29-Sep-94 | 8.00 - 9.50 | Benzene | 0.48 U | µg/kg | SW8020 |
| | | | Toluene | 4.8 U | µg/kg | SW8020 |
| | | | Ethylbenzene | 4.8 U | µg/kg | SW8020 |
| | | | Xylenes (Total) | 4.8 U | µg/kg | SW8020 |
| | | | 1,3,5-Trimethylbenzene | 4.8 U | µg/kg | SW8020 |
| | | | 1,2,4-Trimethylbenzene | 4.8 U | µg/kg | SW8020 |
| | | | 1,2,3-Trimethylbenzene | 4.8 U | µg/kg | SW8020 |

TABLE B.1
VALIDATED SOIL DATA FOR VOLATILE ORGANIC COMPOUNDS
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Sample Interval (ft bgs: begining-ending) | Analyte | Result | Units | Analytical Method |
|-----------------|-------------|--|--------------------------------|--------|-------|-------------------|
| MW9-OT45 | 29-Sep-94 | 8.00 - 9.50 | Benzene | 0.47 U | µg/kg | SW8020 |
| | | | Toluene | 4.7 U | µg/kg | SW8020 |
| | | | Ethylbenzene | 4.7 U | µg/kg | SW8020 |
| | | | Xylenes (Total) | 4.7 U | µg/kg | SW8020 |
| | | | 1,3,5-Trimethylbenzene | 4.7 U | µg/kg | SW8020 |
| | | | 1,2,4-Trimethylbenzene | 0.7 J | µg/kg | SW8020 |
| | | | 1,2,3-Trimethylbenzene | 0.5 J | µg/kg | SW8020 |
| MW10-OT45 | 3-Oct-94 | 9.00 - 11.00 | Benzene | 0.46 U | µg/kg | SW8020 |
| | | | Toluene | 4.6 U | µg/kg | SW8020 |
| | | | Ethylbenzene | 4.6 U | µg/kg | SW8020 |
| | | | Xylenes (Total) | 4.6 U | µg/kg | SW8020 |
| | | | 1,3,5-Trimethylbenzene | 4.6 U | µg/kg | SW8020 |
| | | | 1,2,4-Trimethylbenzene | 4.6 U | µg/kg | SW8020 |
| | | | 1,2,3-Trimethylbenzene | 4.6 U | µg/kg | SW8020 |
| MW11-OT45 | 6-Oct-94 | 10.00 - 12.00 | Benzene | 0.48 U | µg/kg | SW8020 |
| | | | Toluene | 4.8 U | µg/kg | SW8020 |
| | | | Ethylbenzene | 4.8 U | µg/kg | SW8020 |
| | | | Xylenes (Total) | 4.8 U | µg/kg | SW8020 |
| | | | 1,3,5-Trimethylbenzene | 4.8 U | µg/kg | SW8020 |
| | | | 1,2,4-Trimethylbenzene | 4.8 U | µg/kg | SW8020 |
| | | | 1,2,3-Trimethylbenzene | 4.8 U | µg/kg | SW8020 |
| VW1-OT45 | 28-Sep-94 | 8.00 - 9.50 | Total Extractable Hydrocarbons | 45 J | mg/kg | M8015 |
| | | | Benzene | 0.45 U | µg/kg | SW8020 |
| | | | Toluene | 4.5 U | µg/kg | SW8020 |
| | | | Ethylbenzene | 4.5 U | µg/kg | SW8020 |
| | | | Xylenes (Total) | 4.5 U | µg/kg | SW8020 |
| | | | 1,3,5-Trimethylbenzene | 0.7 J | µg/kg | SW8020 |
| | | | 1,2,4-Trimethylbenzene | 4.5 U | µg/kg | SW8020 |
| | | | 1,2,3-Trimethylbenzene | 4.5 U | µg/kg | SW8020 |

" J= estimated value

" U= analyte not detected above method detection limit

" UJ=estimated concentration of analyte not detected above method detection limit

TABLE B.2
VALIDATED SOIL DATA FOR SEMIVOLATILE ORGANIC COMPOUNDS
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Sample Interval (ft bgs: begining-ending) | Analyte | Result | Units | Analytical Method |
|------------------|-------------|--|------------------------|--------------------|-------|-------------------|
| DC-OT45 (MW2) | 28-Sep-94 | 12.00 - 15.00 | Naphthalene | 790 | µg/kg | SW8270 |
| | | | 2-Methylnaphthalene | 380 U ^a | µg/kg | SW8270 |
| | | | Acenaphthylene | 380 U | µg/kg | SW8270 |
| | | | Acenaphthene | 220 J ^a | µg/kg | SW8270 |
| | | | Dibenzofuran | 110 J | µg/kg | SW8270 |
| | | | Fluorene | 310 J | µg/kg | SW8270 |
| | | | Phenanthrene | 380 U | µg/kg | SW8270 |
| | | | Anthracene | 380 U | µg/kg | SW8270 |
| | | | Fluoranthene | 380 U | µg/kg | SW8270 |
| | | | Pyrene | 45 J | µg/kg | SW8270 |
| | | | Benzo(a)anthracene | 380 U | µg/kg | SW8270 |
| | | | Chrysene | 380 U | µg/kg | SW8270 |
| | | | Benzo(b)fluoranthene | 380 U | µg/kg | SW8270 |
| | | | Benzo(k)fluoranthene | 380 U | µg/kg | SW8270 |
| | | | Benzo(a)pyrene | 380 U | µg/kg | SW8270 |
| | | | Indeno(1,2,3-cd)pyrene | 380 U | µg/kg | SW8270 |
| | | | Dibenz(a,h)anthracene | 380 U | µg/kg | SW8270 |
| | | | Benzo(g,h,i)perylene | 380 U | µg/kg | SW8270 |
| MPA-OT45 | 28-Sep-94 | 8.00 - 9.50 | Naphthalene | 370 U | µg/kg | SW8270 |
| | | | 2-Methylnaphthalene | 370 U | µg/kg | SW8270 |
| | | | Acenaphthylene | 370 U | µg/kg | SW8270 |
| | | | Acenaphthene | 370 U | µg/kg | SW8270 |
| | | | Dibenzofuran | 370 U | µg/kg | SW8270 |
| | | | Fluorene | 370 U | µg/kg | SW8270 |
| | | | Phenanthrene | 370 U | µg/kg | SW8270 |
| | | | Anthracene | 370 U | µg/kg | SW8270 |
| | | | Fluoranthene | 370 U | µg/kg | SW8270 |
| | | | Pyrene | 370 U | µg/kg | SW8270 |
| | | | Benzo(a)anthracene | 370 U | µg/kg | SW8270 |
| | | | Chrysene | 370 U | µg/kg | SW8270 |
| | | | Benzo(b)fluoranthene | 370 U | µg/kg | SW8270 |
| | | | Benzo(k)fluoranthene | 370 U | µg/kg | SW8270 |
| | | | Benzo(a)pyrene | 370 U | µg/kg | SW8270 |
| | | | Indeno(1,2,3-cd)pyrene | 370 U | µg/kg | SW8270 |
| | | | Dibenz(a,h)anthracene | 370 U | µg/kg | SW8270 |
| | | | Benzo(g,h,i)perylene | 370 U | µg/kg | SW8270 |
| MPB-OT45 | 28-Sep-94 | 8.00 - 9.50 | Naphthalene | 330 U | µg/kg | SW8270 |
| | | | 2-Methylnaphthalene | 330 U | µg/kg | SW8270 |
| | | | Acenaphthylene | 330 U | µg/kg | SW8270 |
| | | | Acenaphthene | 330 U | µg/kg | SW8270 |
| | | | Dibenzofuran | 330 U | µg/kg | SW8270 |
| | | | Fluorene | 330 U | µg/kg | SW8270 |
| | | | Phenanthrene | 330 U | µg/kg | SW8270 |
| | | | Anthracene | 330 U | µg/kg | SW8270 |
| | | | Fluoranthene | 330 U | µg/kg | SW8270 |
| | | | Pyrene | 180 J | µg/kg | SW8270 |
| | | | Benzo(a)anthracene | 330 U | µg/kg | SW8270 |
| | | | Chrysene | 330 U | µg/kg | SW8270 |
| | | | Benzo(b)fluoranthene | 330 U | µg/kg | SW8270 |
| | | | Benzo(k)fluoranthene | 330 U | µg/kg | SW8270 |
| | | | Benzo(a)pyrene | 330 U | µg/kg | SW8270 |
| | | | Indeno(1,2,3-cd)pyrene | 330 U | µg/kg | SW8270 |
| | | | Dibenz(a,h)anthracene | 330 U | µg/kg | SW8270 |
| | | | Benzo(g,h,i)perylene | 330 U | µg/kg | SW8270 |
| MW4-OT45 | 29-Sep-94 | 8.00 - 9.50 | Naphthalene | 350 U | µg/kg | SW8270 |

TABLE B.2
VALIDATED SOIL DATA FOR SEMIVOLATILE ORGANIC COMPOUNDS
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Sample Interval (ft bgs: begining-ending) | Analyte | Result | Units | Analytical Method |
|-----------------|-------------|--|------------------------|--------|-------|-------------------|
| MW4-OT45 | 29-Sep-94 | 8.00 - 9.50 | 2-Methylnaphthalene | 350 U | µg/kg | SW8270 |
| | | | Acenaphthylene | 350 U | µg/kg | SW8270 |
| | | | Acenaphthene | 350 U | µg/kg | SW8270 |
| | | | Dibenzofuran | 350 U | µg/kg | SW8270 |
| | | | Fluorene | 350 U | µg/kg | SW8270 |
| | | | Phenanthrene | 350 U | µg/kg | SW8270 |
| | | | Anthracene | 350 U | µg/kg | SW8270 |
| | | | Fluoranthene | 350 U | µg/kg | SW8270 |
| | | | Pyrene | 350 U | µg/kg | SW8270 |
| | | | Benzo(a)anthracene | 350 U | µg/kg | SW8270 |
| | | | Chrysene | 350 U | µg/kg | SW8270 |
| | | | Benzo(b)fluoranthene | 350 U | µg/kg | SW8270 |
| | | | Benzo(k)fluoranthene | 350 U | µg/kg | SW8270 |
| | | | Benzo(a)pyrene | 350 U | µg/kg | SW8270 |
| | | | Indeno(1,2,3-cd)pyrene | 350 U | µg/kg | SW8270 |
| | | | Dibenz(a,h)anthracene | 350 U | µg/kg | SW8270 |
| | | | Benzo(g,h,i)perylene | 350 U | µg/kg | SW8270 |
| MW5-OT45 | 29-Sep-94 | 10.00 - 13.00 | Naphthalene | 1400 | µg/kg | SW8270 |
| | | | 2-Methylnaphthalene | 7000 | µg/kg | SW8270 |
| | | | Acenaphthylene | 390 U | µg/kg | SW8270 |
| | | | Acenaphthene | 380 J | µg/kg | SW8270 |
| | | | Dibenzofuran | 390 U | µg/kg | SW8270 |
| | | | Fluorene | 550 | µg/kg | SW8270 |
| | | | Phenanthrene | 1600 | µg/kg | SW8270 |
| | | | Anthracene | 390 U | µg/kg | SW8270 |
| | | | Fluoranthene | 390 U | µg/kg | SW8270 |
| | | | Pyrene | 51 J | µg/kg | SW8270 |
| | | | Benzo(a)anthracene | 390 U | µg/kg | SW8270 |
| | | | Chrysene | 390 U | µg/kg | SW8270 |
| | | | Benzo(b)fluoranthene | 390 U | µg/kg | SW8270 |
| | | | Benzo(k)fluoranthene | 390 U | µg/kg | SW8270 |
| | | | Benzo(a)pyrene | 390 U | µg/kg | SW8270 |
| | | | Indeno(1,2,3-cd)pyrene | 390 U | µg/kg | SW8270 |
| | | | Dibenz(a,h)anthracene | 390 U | µg/kg | SW8270 |
| | | | Benzo(g,h,i)perylene | 390 U | µg/kg | SW8270 |
| MW6-OT45 | 29-Sep-94 | 8.00 - 9.50 | Naphthalene | 410 U | µg/kg | SW8270 |
| | | | 2-Methylnaphthalene | 410 U | µg/kg | SW8270 |
| | | | Acenaphthylene | 410 U | µg/kg | SW8270 |
| | | | Acenaphthene | 410 U | µg/kg | SW8270 |
| | | | Dibenzofuran | 410 U | µg/kg | SW8270 |
| | | | Fluorene | 410 U | µg/kg | SW8270 |
| | | | Phenanthrene | 410 U | µg/kg | SW8270 |
| | | | Anthracene | 410 U | µg/kg | SW8270 |
| | | | Fluoranthene | 410 U | µg/kg | SW8270 |
| | | | Pyrene | 410 U | µg/kg | SW8270 |
| | | | Benzo(a)anthracene | 410 U | µg/kg | SW8270 |
| | | | Chrysene | 410 U | µg/kg | SW8270 |
| | | | Benzo(b)fluoranthene | 410 U | µg/kg | SW8270 |
| | | | Benzo(k)fluoranthene | 410 U | µg/kg | SW8270 |
| | | | Benzo(a)pyrene | 410 U | µg/kg | SW8270 |
| | | | Indeno(1,2,3-cd)pyrene | 410 U | µg/kg | SW8270 |
| | | | Dibenz(a,h)anthracene | 410 U | µg/kg | SW8270 |
| | | | Benzo(g,h,i)perylene | 410 U | µg/kg | SW8270 |
| MW7-OT45 | 27-Sep-94 | 8.00 - 9.00 | Naphthalene | 330 U | µg/kg | SW8270 |
| | | | 2-Methylnaphthalene | 330 U | µg/kg | SW8270 |

TABLE B.2
VALIDATED SOIL DATA FOR SEMIVOLATILE ORGANIC COMPOUNDS
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Sample Interval (ft bgs: begining-ending) | Analyte | Result | Units | Analytical Method |
|-----------------|-------------|--|------------------------|--------|-------|-------------------|
| MW7-OT45 | 27-Sep-94 | 8.00 - 9.00 | Acenaphthylene | 330 U | µg/kg | SW8270 |
| | | | Acenaphthene | 330 U | µg/kg | SW8270 |
| | | | Dibenzofuran | 330 U | µg/kg | SW8270 |
| | | | Fluorene | 330 U | µg/kg | SW8270 |
| | | | Phenanthrene | 330 U | µg/kg | SW8270 |
| | | | Anthracene | 330 U | µg/kg | SW8270 |
| | | | Fluoranthene | 330 U | µg/kg | SW8270 |
| | | | Pyrene | 330 U | µg/kg | SW8270 |
| | | | Benzo(a)anthracene | 330 U | µg/kg | SW8270 |
| | | | Chrysene | 330 U | µg/kg | SW8270 |
| | | | Benzo(b)fluoranthene | 330 U | µg/kg | SW8270 |
| | | | Benzo(k)fluoranthene | 330 U | µg/kg | SW8270 |
| | | | Benzo(a)pyrene | 330 U | µg/kg | SW8270 |
| | | | Indeno(1,2,3-cd)pyrene | 330 U | µg/kg | SW8270 |
| | | | Dibenz(a,h)anthracene | 330 U | µg/kg | SW8270 |
| | | | Benzo(g,h,i)perylene | 330 U | µg/kg | SW8270 |
| MW8-OT45 | 29-Sep-94 | 8.00 - 9.50 | Naphthalene | 400 U | µg/kg | SW8270 |
| | | | 2-Methylnaphthalene | 400 U | µg/kg | SW8270 |
| | | | Acenaphthylene | 400 U | µg/kg | SW8270 |
| | | | Acenaphthene | 400 U | µg/kg | SW8270 |
| | | | Dibenzofuran | 400 U | µg/kg | SW8270 |
| | | | Fluorene | 400 U | µg/kg | SW8270 |
| | | | Phenanthrene | 400 U | µg/kg | SW8270 |
| | | | Anthracene | 400 U | µg/kg | SW8270 |
| | | | Fluoranthene | 400 U | µg/kg | SW8270 |
| | | | Pyrene | 400 U | µg/kg | SW8270 |
| | | | Benzo(a)anthracene | 400 U | µg/kg | SW8270 |
| | | | Chrysene | 400 U | µg/kg | SW8270 |
| | | | Benzo(b)fluoranthene | 400 U | µg/kg | SW8270 |
| | | | Benzo(k)fluoranthene | 400 U | µg/kg | SW8270 |
| | | | Benzo(a)pyrene | 400 U | µg/kg | SW8270 |
| | | | Indeno(1,2,3-cd)pyrene | 400 U | µg/kg | SW8270 |
| | | | Dibenz(a,h)anthracene | 400 U | µg/kg | SW8270 |
| | | | Benzo(g,h,i)perylene | 400 U | µg/kg | SW8270 |
| MW9-OT45 | 29-Sep-94 | 8.00 - 9.50 | Naphthalene | 380 U | µg/kg | SW8270 |
| | | | 2-Methylnaphthalene | 380 U | µg/kg | SW8270 |
| | | | Acenaphthylene | 380 U | µg/kg | SW8270 |
| | | | Acenaphthene | 380 U | µg/kg | SW8270 |
| | | | Dibenzofuran | 380 U | µg/kg | SW8270 |
| | | | Fluorene | 380 U | µg/kg | SW8270 |
| | | | Phenanthrene | 380 U | µg/kg | SW8270 |
| | | | Anthracene | 380 U | µg/kg | SW8270 |
| | | | Fluoranthene | 380 U | µg/kg | SW8270 |
| | | | Pyrene | 380 U | µg/kg | SW8270 |
| | | | Benzo(a)anthracene | 380 U | µg/kg | SW8270 |
| | | | Chrysene | 380 U | µg/kg | SW8270 |
| | | | Benzo(b)fluoranthene | 380 U | µg/kg | SW8270 |
| | | | Benzo(k)fluoranthene | 380 U | µg/kg | SW8270 |
| | | | Benzo(a)pyrene | 380 U | µg/kg | SW8270 |
| | | | Indeno(1,2,3-cd)pyrene | 380 U | µg/kg | SW8270 |
| | | | Dibenz(a,h)anthracene | 380 U | µg/kg | SW8270 |
| | | | Benzo(g,h,i)perylene | 380 U | µg/kg | SW8270 |
| MW10-OT45 | 3-Oct-94 | 9.00 - 11.00 | Naphthalene | 380 U | µg/kg | SW8270 |
| | | | 2-Methylnaphthalene | 380 U | µg/kg | SW8270 |
| | | | Acenaphthylene | 380 U | µg/kg | SW8270 |

TABLE B.2
VALIDATED SOIL DATA FOR SEMIVOLATILE ORGANIC COMPOUNDS
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Sample Interval (ft bgs: beginning-ending) | Analyte | Result | Units | Analytical Method |
|-----------------|-------------|---|------------------------|--------|-------|-------------------|
| MW10-OT45 | 3-Oct-94 | 9.00 - 11.00 | Acenaphthene | 380 U | µg/kg | SW8270 |
| | | | Dibenzofuran | 380 U | µg/kg | SW8270 |
| | | | Fluorene | 380 U | µg/kg | SW8270 |
| | | | Phenanthrene | 380 U | µg/kg | SW8270 |
| | | | Anthracene | 380 U | µg/kg | SW8270 |
| | | | Fluoranthene | 380 U | µg/kg | SW8270 |
| | | | Pyrene | 380 U | µg/kg | SW8270 |
| | | | Benzo(a)anthracene | 380 U | µg/kg | SW8270 |
| | | | Chrysene | 380 U | µg/kg | SW8270 |
| | | | Benzo(b)fluoranthene | 380 U | µg/kg | SW8270 |
| | | | Benzo(k)fluoranthene | 380 U | µg/kg | SW8270 |
| | | | Benzo(a)pyrene | 380 U | µg/kg | SW8270 |
| | | | Indeno(1,2,3-cd)pyrene | 380 U | µg/kg | SW8270 |
| | | | Dibenz(a,h)anthracene | 380 U | µg/kg | SW8270 |
| | | | Benzo(g,h,i)perylene | 380 U | µg/kg | SW8270 |
| MW11-OT45 | 6-Oct-94 | 10.00 - 12.00 | Naphthalene | 360 U | µg/kg | SW8270 |
| | | | 2-Methylnaphthalene | 360 U | µg/kg | SW8270 |
| | | | Acenaphthylene | 360 U | µg/kg | SW8270 |
| | | | Acenaphthene | 360 U | µg/kg | SW8270 |
| | | | Dibenzofuran | 360 U | µg/kg | SW8270 |
| | | | Fluorene | 360 U | µg/kg | SW8270 |
| | | | Phenanthrene | 360 U | µg/kg | SW8270 |
| | | | Anthracene | 360 U | µg/kg | SW8270 |
| | | | Fluoranthene | 360 U | µg/kg | SW8270 |
| | | | Pyrene | 360 U | µg/kg | SW8270 |
| | | | Benzo(a)anthracene | 360 U | µg/kg | SW8270 |
| | | | Chrysene | 360 U | µg/kg | SW8270 |
| | | | Benzo(b)fluoranthene | 360 U | µg/kg | SW8270 |
| | | | Benzo(k)fluoranthene | 360 U | µg/kg | SW8270 |
| | | | Benzo(a)pyrene | 360 U | µg/kg | SW8270 |
| | | | Indeno(1,2,3-cd)pyrene | 360 U | µg/kg | SW8270 |
| | | | Dibenz(a,h)anthracene | 360 U | µg/kg | SW8270 |
| | | | Benzo(g,h,i)perylene | 360 U | µg/kg | SW8270 |
| VW1-OT45 | 28-Sep-94 | 8.00 - 9.50 | Naphthalene | 330 U | µg/kg | SW8270 |
| | | | 2-Methylnaphthalene | 330 U | µg/kg | SW8270 |
| | | | Acenaphthylene | 330 U | µg/kg | SW8270 |
| | | | Acenaphthene | 330 U | µg/kg | SW8270 |
| | | | Dibenzofuran | 330 U | µg/kg | SW8270 |
| | | | Fluorene | 330 U | µg/kg | SW8270 |
| | | | Phenanthrene | 330 U | µg/kg | SW8270 |
| | | | Anthracene | 330 U | µg/kg | SW8270 |
| | | | Fluoranthene | 330 U | µg/kg | SW8270 |
| | | | Pyrene | 330 U | µg/kg | SW8270 |
| | | | Benzo(a)anthracene | 330 U | µg/kg | SW8270 |
| | | | Chrysene | 330 U | µg/kg | SW8270 |
| | | | Benzo(b)fluoranthene | 330 U | µg/kg | SW8270 |
| | | | Benzo(k)fluoranthene | 330 U | µg/kg | SW8270 |
| | | | Benzo(a)pyrene | 330 U | µg/kg | SW8270 |
| | | | Indeno(1,2,3-cd)pyrene | 330 U | µg/kg | SW8270 |
| | | | Dibenz(a,h)anthracene | 330 U | µg/kg | SW8270 |
| | | | Benzo(g,h,i)perylene | 330 U | µg/kg | SW8270 |
| MPA-OT45 | 7-Oct-94 | 0.00 - .25 | Naphthalene | 360 U | µg/kg | SW8270 |
| | | | 2-Methylnaphthalene | 360 U | µg/kg | SW8270 |
| | | | Acenaphthylene | 360 U | µg/kg | SW8270 |
| | | | Acenaphthene | 360 U | µg/kg | SW8270 |

TABLE B.2
VALIDATED SOIL DATA FOR SEMIVOLATILE ORGANIC COMPOUNDS
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Sample Interval (ft bgs: begining-ending) | Analyte | Result | Units | Analytical Method |
|-----------------|-------------|--|------------------------|--------|-------|-------------------|
| | | | Dibenzofuran | 360 U | µg/kg | SW8270 |
| | | | Fluorene | 360 U | µg/kg | SW8270 |
| | | | Phenanthrene | 360 U | µg/kg | SW8270 |
| | | | Anthracene | 360 U | µg/kg | SW8270 |
| | | | Fluoranthene | 38 J | µg/kg | SW8270 |
| | | | Pyrene | 56 J | µg/kg | SW8270 |
| | | | Benzo(a)anthracene | 33 J | µg/kg | SW8270 |
| | | | Chrysene | 41 J | µg/kg | SW8270 |
| | | | Benzo(b)fluoranthene | 57 J | µg/kg | SW8270 |
| | | | Benzo(k)fluoranthene | 22 J | µg/kg | SW8270 |
| | | | Benzo(a)pyrene | 34 J | µg/kg | SW8270 |
| | | | Indeno(1,2,3-cd)pyrene | 32 J | µg/kg | SW8270 |
| | | | Dibenz(a,h)anthracene | 360 U | µg/kg | SW8270 |
| | | | Benzo(g,h,i)perylene | 30 J | µg/kg | SW8270 |
| MPB-OT45 | 7-Oct-94 | 0.00 - .25 | Naphthalene | 410 U | µg/kg | SW8270 |
| | | | 2-Methylnaphthalene | 410 U | µg/kg | SW8270 |
| | | | Acenaphthylene | 410 U | µg/kg | SW8270 |
| | | | Acenaphthene | 410 U | µg/kg | SW8270 |
| | | | Dibenzofuran | 410 U | µg/kg | SW8270 |
| | | | Fluorene | 410 U | µg/kg | SW8270 |
| | | | Phenanthrene | 410 U | µg/kg | SW8270 |
| | | | Anthracene | 410 U | µg/kg | SW8270 |
| | | | Fluoranthene | 33 J | µg/kg | SW8270 |
| | | | Pyrene | 47 J | µg/kg | SW8270 |
| | | | Benzo(a)anthracene | 27 J | µg/kg | SW8270 |
| | | | Chrysene | 26 J | µg/kg | SW8270 |
| | | | Benzo(b)fluoranthene | 34 J | µg/kg | SW8270 |
| | | | Benzo(k)fluoranthene | 410 U | µg/kg | SW8270 |
| | | | Benzo(a)pyrene | 21 J | µg/kg | SW8270 |
| | | | Indeno(1,2,3-cd)pyrene | 410 U | µg/kg | SW8270 |
| | | | Dibenz(a,h)anthracene | 410 U | µg/kg | SW8270 |
| | | | Benzo(g,h,i)perylene | 410 U | µg/kg | SW8270 |
| VW1-OT45 | 7-Oct-94 | 0.00 - .25 | Naphthalene | 360 U | µg/kg | SW8270 |
| | | | 2-Methylnaphthalene | 360 U | µg/kg | SW8270 |
| | | | Acenaphthylene | 360 U | µg/kg | SW8270 |
| | | | Acenaphthene | 360 U | µg/kg | SW8270 |
| | | | Dibenzofuran | 360 U | µg/kg | SW8270 |
| | | | Fluorene | 360 U | µg/kg | SW8270 |
| | | | Phenanthrene | 360 U | µg/kg | SW8270 |
| | | | Anthracene | 360 U | µg/kg | SW8270 |
| | | | Fluoranthene | 360 U | µg/kg | SW8270 |
| | | | Pyrene | 360 U | µg/kg | SW8270 |
| | | | Benzo(a)anthracene | 360 U | µg/kg | SW8270 |
| | | | Chrysene | 360 U | µg/kg | SW8270 |
| | | | Benzo(b)fluoranthene | 360 U | µg/kg | SW8270 |
| | | | Benzo(k)fluoranthene | 360 U | µg/kg | SW8270 |
| | | | Benzo(a)pyrene | 360 U | µg/kg | SW8270 |
| | | | Indeno(1,2,3-cd)pyrene | 360 U | µg/kg | SW8270 |
| | | | Dibenz(a,h)anthracene | 360 U | µg/kg | SW8270 |
| | | | Benzo(g,h,i)perylene | 360 U | µg/kg | SW8270 |

U= analyte not detected above method detection limit
J= estimated value

TABLE B.3
VALIDATED SOIL DATA FOR OTHER ANALYSIS
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Sample Interval (ft bgs: beginning-ending) | Analyte | Result | Units | Analytical Method |
|-----------------|-------------|---|----------------------------------|---------------------|----------|-------------------|
| MPA-OT45 | 28-Sep-94 | 8.00 - 9.50 | Moisture, Percent | 10 | % | E160.3 |
| | | | Phosphorus, Total Orthophosphate | 2.78 U ^a | mg/kg | E300.0 |
| | | | Nitrogen, Total Kjeldahl | 5.35 U | mg/kg | E351.3 |
| | | | pH | 7.83 | pH units | SW9045 |
| MPB-OT45 | 28-Sep-94 | 8.00 - 9.50 | Moisture, Percent | 9.1 | % | E160.3 |
| | | | Phosphorus, Total Orthophosphate | 2.75 U | mg/kg | E300.0 |
| | | | Nitrogen, Total Kjeldahl | 5.4 U | mg/kg | E351.3 |
| | | | Iron | 1300 | mg/kg | SW6010 |
| | | | Alkalinity, Carbonate | 27.5 U | mg/kg | E310.1 |
| MW4-OT45 | 29-Sep-94 | 8.00 - 9.50 | pH | 7.22 | pH units | SW9045 |
| | | | Nitrogen, Total Kjeldahl | 5.75 U | mg/kg | E351.3 |
| MW6-OT45 | 29-Sep-94 | 8.00 - 9.50 | Total Organic Carbon | 0.15 | % | SW9060 |
| MW8-OT45 | 29-Sep-94 | 8.00 - 9.50 | Total Organic Carbon | 0.06 | % | SW9060 |
| MW10-OT45 | 6-Oct-94 | 68 - 70 | Total Organic Carbon | 0.06 | % | SW9060 |
| | | | Phosphorus, Total Orthophosphate | 2.98 U | mg/kg | E300.0 |
| | | | Nitrogen, Total Kjeldahl | 195 | mg/kg | E351.3 |
| | | | pH | 9.28 | pH units | SW9045 |
| MW11-OT45 | 7-Oct-94 | 12.00 - 14.00 | Total Organic Carbon | 0.16 | % | SW9060 |
| | | | Total Organic Carbon | 0.05 U | % | SW9060 |
| VW1-OT45 | 28-Sep-94 | 8.00 - 9.50 | Moisture, Percent | 11.5 | % | E160.3 |
| | | | Phosphorus, Total Orthophosphate | 2.84 U | mg/kg | E300.0 |
| | | | Nitrogen, Total Kjeldahl | 5.51 U | mg/kg | E351.3 |
| | | | Iron | 1500 | mg/kg | SW6010 |
| | | | Alkalinity, Carbonate | 28.2 U | mg/kg | E310.1 |
| | | | pH | 7.86 | pH units | SW9045 |

^a U= analyte not detected above method detection limit

TABLE B.4
VALIDATED SOIL GAS DATA FOR VOLATILE ORGANIC COMPOUNDS
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Sample Interval (ft bgs: beginning-ending) | Analyte | Result | Units | Analytical Method |
|-----------------|-------------|---|------------------------|----------------------|-------|-------------------|
| MPB-OT45 | 11-Oct-94 | 9.00 - 9.50 | Benzene | 0.017 U ^a | µg/L | TO3 |
| | | | Toluene | 0.02 U | µg/L | TO3 |
| | | | Ethylbenzene | 1.4 | µg/L | TO3 |
| | | | Xylenes (Total) | 3.2 | µg/L | TO3 |
| | | | Petroleum Hydrocarbons | 2100 | µg/L | TO3 |
| MW2-OT45 | 8-Oct-94 | 5.00 - 10.00 | Benzene | 0.006 U | µg/L | TO3 |
| | | | Toluene | 0.008 U | µg/L | TO3 |
| | | | Ethylbenzene | 0.17 | µg/L | TO3 |
| | | | Xylenes (Total) | 0.53 | µg/L | TO3 |
| | | | Petroleum Hydrocarbons | 380 | µg/L | TO3 |
| VW1-OT45 | 8-Oct-94 | 5.00 - 10.00 | Benzene | 0.006 U | µg/L | TO3 |
| | | | Toluene | 0.008 U | µg/L | TO3 |
| | | | Ethylbenzene | 0.26 | µg/L | TO3 |
| | | | Xylenes (Total) | 1 | µg/L | TO3 |
| | | | Petroleum Hydrocarbons | 910 | µg/L | TO3 |

^a U= analyte not detected above method detection limit

TABLE B.5
VALIDATED SOIL FLUX DATA FOR VOLATILE ORGANIC COMPOUNDS
AND TOTAL PETROLEUM HYDROCARBONS
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Analyte | Result | Units | Analytical Method |
|-----------------|-------------|------------------------|----------------------|-------|-------------------|
| BKG-OT45 | 11-Oct-94 | Benzene | 0.006 U ^a | µg/L | TO3 |
| | | Toluene | 0.008 U | µg/L | TO3 |
| | | Ethylbenzene | 0.009 U | µg/L | TO3 |
| | | Xylenes (Total) | 0.031 | µg/L | TO3 |
| | | Petroleum Hydrocarbons | 13 | µg/L | TO3 |
| MPB-OT45 | 11-Oct-94 | Benzene | 0.006 U | µg/L | TO3 |
| | | Toluene | 0.034 | µg/L | TO3 |
| | | Ethylbenzene | 0.009 U | µg/L | TO3 |
| | | Xylenes (Total) | 0.013 | µg/L | TO3 |
| | | Petroleum Hydrocarbons | 1.6 | µg/L | TO3 |
| MPB-OT45 | 18-Oct-94 | Benzene | 0.007 U | µg/L | TO3 |
| | | Toluene | 0.008 U | µg/L | TO3 |
| | | Ethylbenzene | 0.009 U | µg/L | TO3 |
| | | Xylenes (Total) | 0.009 U | µg/L | TO3 |
| | | Petroleum Hydrocarbons | 1.4 | µg/L | TO3 |
| MW2-OT45 | 11-Oct-94 | Benzene | 0.006 U | µg/L | TO3 |
| | | Toluene | 0.008 | µg/L | TO3 |
| | | Ethylbenzene | 0.009 U | µg/L | TO3 |
| | | Xylenes (Total) | 0.009 U | µg/L | TO3 |
| | | Petroleum Hydrocarbons | 4.9 | µg/L | TO3 |
| MW2-OT45 | 18-Oct-94 | Benzene | 0.007 U | µg/L | TO3 |
| | | Toluene | 0.023 | µg/L | TO3 |
| | | Ethylbenzene | 0.009 U | µg/L | TO3 |
| | | Xylenes (Total) | 0.009 U | µg/L | TO3 |
| | | Petroleum Hydrocarbons | 3.1 | µg/L | TO3 |
| VW1-OT45 | 11-Oct-94 | Benzene | 0.006 U | µg/L | TO3 |
| | | Toluene | 0.038 | µg/L | TO3 |
| | | Ethylbenzene | 0.009 U | µg/L | TO3 |
| | | Xylenes (Total) | 0.009 U | µg/L | TO3 |
| | | Petroleum Hydrocarbons | 2.6 | µg/L | TO3 |
| VW1-OT45 | 18-Oct-94 | Benzene | 0.007 U | µg/L | TO3 |
| | | Toluene | 0.008 | µg/L | TO3 |
| | | Ethylbenzene | 0.009 U | µg/L | TO3 |
| | | Xylenes (Total) | 0.009 U | µg/L | TO3 |
| | | Petroleum Hydrocarbons | 1 | µg/L | TO3 |

^a U= analyte not detected above method detection limit

TABLE B.5
FLUX CALCULATIONS
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT45, WURTSMITH AFB, MICHIGAN

| BG-10/11/94 | | | | | | | | | | |
|--------------|-------------|---|----------------|----------|-----------------------|---------|---------|------------|----------|-----------------------------|
| ANALYTE | MEAS. CONC. | | AREA | FLOWRATE | Erate(uncor.) | temp(c) | temp(a) | C factor | Erate | |
| | µg/L | | m ² | L/min | µg/min m ² | | | | | |
| benzene | 0.006 | 0 | 0.164 | 5 | 0.18292683 | 15.9 | 9.8 | 2.21001654 | 0.404271 | MDL USED TO CALC. EMISSIONS |
| toluene | 0.009 | 0 | 0.164 | 5 | 0.27439024 | | | | 0.606407 | MDL USED TO CALC. EMISSIONS |
| ethylbenzene | 0.009 | 0 | 0.164 | 5 | 0.27439024 | | | | 0.606407 | MDL USED TO CALC. EMISSIONS |
| xylenes | 0.031 | 1 | 0.164 | 5 | 0.94512195 | | | | 2.088735 | ANALYTE DETECTED |
| lph | 13 | 1 | 0.164 | 5 | 396.341463 | | | | 875.9212 | ANALYTE DETECTED |
| VW1-10/11/94 | | | | | | | | | | |
| ANALYTE | MEAS. CONC. | | AREA | FLOWRATE | Erate(uncor.) | temp(c) | temp(a) | C factor | Erate | |
| | µg/L | | m ² | L/min | µg/min m ² | | | | | |
| benzene | 0.006 | 0 | 0.164 | 5 | 0.18292683 | 10.9 | 11.8 | 0.88958519 | 0.162729 | MDL USED TO CALC. EMISSIONS |
| toluene | 0.038 | 1 | 0.164 | 5 | 1.15853659 | | | | 1.030617 | ANALYTE DETECTED |
| ethylbenzene | 0.009 | 0 | 0.164 | 5 | 0.27439024 | | | | 0.244093 | MDL USED TO CALC. EMISSIONS |
| xylenes | 0.009 | 0 | 0.164 | 5 | 0.27439024 | | | | 0.244093 | MDL USED TO CALC. EMISSIONS |
| lph | 2.6 | 1 | 0.164 | 5 | 79.2682927 | | | | 70.5159 | ANALYTE DETECTED |
| MPB-10/11/94 | | | | | | | | | | |
| ANALYTE | MEAS. CONC. | | AREA | FLOWRATE | Erate(uncor.) | temp(c) | temp(a) | C factor | Erate | |
| | µg/L | | m ² | L/min | µg/min m ² | | | | | |
| benzene | 0.006 | 0 | 0.164 | 5 | 0.18292683 | 22.5 | 13 | 3.43837852 | 0.628972 | MDL USED TO CALC. EMISSIONS |
| toluene | 0.034 | 1 | 0.164 | 5 | 1.03658537 | | | | 3.564173 | ANALYTE DETECTED |
| ethylbenzene | 0.009 | 0 | 0.164 | 5 | 0.27439024 | | | | 0.943458 | MDL USED TO CALC. EMISSIONS |
| xylenes | 0.013 | 1 | 0.164 | 5 | 0.39634146 | | | | 1.362772 | ANALYTE DETECTED |
| lph | 1.6 | 1 | 0.164 | 5 | 48.7804878 | | | | 167.7258 | ANALYTE DETECTED |
| MW2-10/11/94 | | | | | | | | | | |
| ANALYTE | MEAS. CONC. | | AREA | FLOWRATE | Erate(uncor.) | temp(c) | temp(a) | C factor | Erate | |
| | µg/L | | m ² | L/min | µg/min m ² | | | | | |
| benzene | 0.006 | 0 | 0.164 | 5 | 0.18292683 | 21.2 | 12.8 | 2.98022857 | 0.545164 | MDL USED TO CALC. EMISSIONS |
| toluene | 0.008 | 1 | 0.164 | 5 | 0.24390244 | | | | 0.726885 | ANALYTE DETECTED |
| ethylbenzene | 0.009 | 0 | 0.164 | 5 | 0.27439024 | | | | 0.817746 | MDL USED TO CALC. EMISSIONS |
| xylenes | 0.009 | 0 | 0.164 | 5 | 0.27439024 | | | | 0.817746 | MDL USED TO CALC. EMISSIONS |
| lph | 4.9 | 1 | 0.164 | 5 | 149.390244 | | | | 445.2171 | ANALYTE DETECTED |
| VW1-10/18/94 | | | | | | | | | | |
| ANALYTE | MEAS. CONC. | | AREA | FLOWRATE | Erate(uncor.) | temp(c) | temp(a) | C factor | Erate | |
| | µg/L | | m ² | L/min | µg/min m ² | | | | | |
| benzene | 0.007 | 0 | 0.164 | 5 | 0.21341463 | 15.6 | 16.7 | 0.86675407 | 0.184978 | MDL USED TO CALC. EMISSIONS |
| toluene | 0.008 | 1 | 0.164 | 5 | 0.24390244 | | | | 0.211403 | ANALYTE DETECTED |
| ethylbenzene | 0.009 | 0 | 0.164 | 5 | 0.27439024 | | | | 0.237829 | MDL USED TO CALC. EMISSIONS |
| xylenes | 0.009 | 0 | 0.164 | 5 | 0.27439024 | | | | 0.237829 | MDL USED TO CALC. EMISSIONS |
| lph | 1 | 1 | 0.164 | 5 | 30.4878049 | | | | 26.42543 | ANALYTE DETECTED |
| MPB-10/18/94 | | | | | | | | | | |
| ANALYTE | MEAS. CONC. | | AREA | FLOWRATE | Erate(uncor.) | temp(c) | temp(a) | C factor | Erate | |
| | µg/L | | m ² | L/min | µg/min m ² | | | | | |
| benzene | 0.007 | 0 | 0.164 | 5 | 0.21341463 | 16.8 | 17.2 | 0.94932887 | 0.202601 | MDL USED TO CALC. EMISSIONS |
| toluene | 0.008 | 0 | 0.164 | 5 | 0.24390244 | | | | 0.231544 | MDL USED TO CALC. EMISSIONS |
| ethylbenzene | 0.009 | 0 | 0.164 | 5 | 0.27439024 | | | | 0.260487 | MDL USED TO CALC. EMISSIONS |
| xylenes | 0.009 | 0 | 0.164 | 5 | 0.27439024 | | | | 0.260487 | MDL USED TO CALC. EMISSIONS |
| lph | 1.4 | 1 | 0.164 | 5 | 42.6829268 | | | | 40.52013 | ANALYTE DETECTED |
| MW2-10/18/94 | | | | | | | | | | |
| ANALYTE | MEAS. CONC. | | AREA | FLOWRATE | Erate(uncor.) | temp(c) | temp(a) | C factor | Erate | |
| | µg/L | | m ² | L/min | µg/min m ² | | | | | |
| benzene | 0.007 | 0 | 0.164 | 5 | 0.21341463 | 17.8 | 17.5 | 1.03977048 | 0.221902 | MDL USED TO CALC. EMISSIONS |
| toluene | 0.023 | 1 | 0.164 | 5 | 0.70121951 | | | | 0.729107 | ANALYTE DETECTED |
| ethylbenzene | 0.009 | 0 | 0.164 | 5 | 0.27439024 | | | | 0.285303 | MDL USED TO CALC. EMISSIONS |
| xylenes | 0.009 | 0 | 0.164 | 5 | 0.27439024 | | | | 0.285303 | MDL USED TO CALC. EMISSIONS |
| lph | 3.1 | 1 | 0.164 | 5 | 94.5121951 | | | | 98.27099 | ANALYTE DETECTED |

TABLE B.6
VALIDATED GROUND WATER DATA FOR VOLATILE ORGANIC COMPOUNDS
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Analyte | Result | Units | Analytical Method |
|-----------------|-------------|--------------------------------|--------|-------|-------------------|
| MW6-OT45 | 30-Sep-94 | 1,2,4-Trimethylbenzene | 4 U | µg/L | SW8020 |
| | | 1,2,3-Trimethylbenzene | 4 U | µg/L | SW8020 |
| MW7-OT45 | 28-Sep-94 | Benzene | 1.7 J | µg/L | SW8020 |
| | | Toluene | 0.4 J | µg/L | SW8020 |
| | | Ethylbenzene | 1 J | µg/L | SW8020 |
| | | Xylenes (Total) | 0.6 J | µg/L | SW8020 |
| | | 1,3,5-Trimethylbenzene | 1.3 J | µg/L | SW8020 |
| | | 1,2,4-Trimethylbenzene | 4 U | µg/L | SW8020 |
| | | 1,2,3-Trimethylbenzene | 4 U | µg/L | SW8020 |
| | 12-Oct-94 | Total Extractable Hydrocarbons | 5 U | mg/L | M8015 |
| | | Total Volatile Hydrocarbons | 1 U | mg/L | M8015 |
| MW8-OT45 | 30-Sep-94 | Benzene | 0.4 U | µg/L | SW8020 |
| | | Toluene | 4 U | µg/L | SW8020 |
| | | Ethylbenzene | 4 U | µg/L | SW8020 |
| | | Xylenes (Total) | 4 U | µg/L | SW8020 |
| | | 1,3,5-Trimethylbenzene | 4 U | µg/L | SW8020 |
| | | 1,2,4-Trimethylbenzene | 4 U | µg/L | SW8020 |
| | | 1,2,3-Trimethylbenzene | 4 U | µg/L | SW8020 |
| MW9-OT45 | 12-Oct-94 | Benzene | 0.4 U | µg/L | SW8020 |
| | | Toluene | 4 U | µg/L | SW8020 |
| | | Ethylbenzene | 4 U | µg/L | SW8020 |
| | | Xylenes (Total) | 4 U | µg/L | SW8020 |
| | | 1,3,5-Trimethylbenzene | 4 U | µg/L | SW8020 |
| | | 1,2,4-Trimethylbenzene | 4 U | µg/L | SW8020 |
| | | 1,2,3-Trimethylbenzene | 4 U | µg/L | SW8020 |
| MW10-OT45 | 5-Oct-94 | Benzene | 0.4 U | µg/L | SW8020 |
| | | Toluene | 0.9 J | µg/L | SW8020 |
| | | Ethylbenzene | 4 U | µg/L | SW8020 |
| | | Xylenes (Total) | 4 U | µg/L | SW8020 |
| | | 1,3,5-Trimethylbenzene | 4 U | µg/L | SW8020 |
| | | 1,2,4-Trimethylbenzene | 4 U | µg/L | SW8020 |
| | | 1,2,3-Trimethylbenzene | 4 U | µg/L | SW8020 |
| MW11-OT45 | 12-Oct-94 | Benzene | 1 J | µg/L | SW8240 |
| | | Toluene | 5 U | µg/L | SW8240 |
| | | Ethylbenzene | 5 U | µg/L | SW8240 |
| | | Xylenes (Total) | 5 U | µg/L | SW8240 |
| | | 1,3,5-Trimethylbenzene | 5 U | µg/L | SW8240 |
| | | 1,2,4-Trimethylbenzene | 5 U | µg/L | SW8240 |
| | | 1,2,3-Trimethylbenzene | 5 U | µg/L | SW8240 |
| VW1-OT45 | 10-Oct-94 | Benzene | 0.4 U | µg/L | SW8020 |
| | | Toluene | 1.5 J | µg/L | SW8020 |
| | | Ethylbenzene | 7.2 | µg/L | SW8020 |
| | | Xylenes (Total) | 23 | µg/L | SW8020 |
| | | 1,3,5-Trimethylbenzene | 43 | µg/L | SW8020 |
| | | 1,2,4-Trimethylbenzene | 82 | µg/L | SW8020 |
| | | 1,2,3-Trimethylbenzene | 36 | µg/L | SW8020 |
| | 12-Oct-94 | Total Extractable Hydrocarbons | 5 U | mg/L | M8015 |
| | | Total Volatile Hydrocarbons | 1 U | mg/L | M8015 |

* U= analyte not detected above method detection limit

* J= estimated value

* UJ=estimated concentration of analyte not detected above method detection limit

TABLE B.7
VALIDATED GROUND WATER DATA FOR SEMIVOLATILE ORGANIC COMPOUNDS
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Analyte | Result | Units | Analytical Method |
|-----------------|-------------|------------------------|-------------------|-------|-------------------|
| MPB-OT45 | 10-Oct-94 | Naphthalene | 9 J ^w | µg/L | SW8270 |
| | | 2-Methylnaphthalene | 35 | µg/L | SW8270 |
| | | Acenaphthylene | 10 U ^w | µg/L | SW8270 |
| | | Acenaphthene | 2 J | µg/L | SW8270 |
| | | Dibenzofuran | 10 U | µg/L | SW8270 |
| | | Fluorene | 3 J | µg/L | SW8270 |
| | | Phenanthrene | 7 J | µg/L | SW8270 |
| | | Anthracene | 1 J | µg/L | SW8270 |
| | | Fluoranthene | 10 U | µg/L | SW8270 |
| | | Pyrene | 10 U | µg/L | SW8270 |
| | | Benzo(a)anthracene | 10 U | µg/L | SW8270 |
| | | Chrysene | 10 U | µg/L | SW8270 |
| | | Benzo(b)fluoranthene | 10 U | µg/L | SW8270 |
| | | Benzo(k)fluoranthene | 10 U | µg/L | SW8270 |
| | | Benzo(a)pyrene | 10 U | µg/L | SW8270 |
| | | Indeno(1,2,3-cd)pyrene | 10 U | µg/L | SW8270 |
| | | Dibenz(a,h)anthracene | 10 U | µg/L | SW8270 |
| | | Benzo(g,h,i)perylene | 10 U | µg/L | SW8270 |
| MW1-OT45 | 13-Oct-94 | Naphthalene | 10 U | µg/L | SW8270 |
| | | 2-Methylnaphthalene | 10 U | µg/L | SW8270 |
| | | Acenaphthylene | 10 U | µg/L | SW8270 |
| | | Acenaphthene | 10 U | µg/L | SW8270 |
| | | Dibenzofuran | 10 U | µg/L | SW8270 |
| | | Fluorene | 10 U | µg/L | SW8270 |
| | | Phenanthrene | 10 U | µg/L | SW8270 |
| | | Anthracene | 10 U | µg/L | SW8270 |
| | | Fluoranthene | 10 U | µg/L | SW8270 |
| | | Pyrene | 10 U | µg/L | SW8270 |
| | | Benzo(a)anthracene | 10 U | µg/L | SW8270 |
| | | Chrysene | 10 U | µg/L | SW8270 |
| | | Benzo(b)fluoranthene | 10 U | µg/L | SW8270 |
| | | Benzo(k)fluoranthene | 10 U | µg/L | SW8270 |
| | | Benzo(a)pyrene | 10 U | µg/L | SW8270 |
| | | Indeno(1,2,3-cd)pyrene | 10 U | µg/L | SW8270 |
| | | Dibenz(a,h)anthracene | 10 U | µg/L | SW8270 |
| | | Benzo(g,h,i)perylene | 10 U | µg/L | SW8270 |
| MW2-OT45 | 10-Oct-94 | Naphthalene | 150 | µg/L | SW8270 |
| | | 2-Methylnaphthalene | 230 | µg/L | SW8270 |
| | | Acenaphthylene | 10 U | µg/L | SW8270 |
| | | Acenaphthene | 19 | µg/L | SW8270 |
| | | Dibenzofuran | 10 U | µg/L | SW8270 |
| | | Fluorene | 26 | µg/L | SW8270 |
| | | Phenanthrene | 70 | µg/L | SW8270 |
| | | Anthracene | 5 J | µg/L | SW8270 |
| | | Fluoranthene | 10 U | µg/L | SW8270 |
| | | Pyrene | 10 U | µg/L | SW8270 |
| | | Benzo(a)anthracene | 10 U | µg/L | SW8270 |
| | | Chrysene | 10 U | µg/L | SW8270 |

TABLE B.6
VALIDATED GROUND WATER DATA FOR VOLATILE ORGANIC COMPOUNDS
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Analyte | Result | Units | Analytical Method |
|-----------------|-------------|--------------------------------|--------------------|-------|-------------------|
| MPB-OT45 | 10-Oct-94 | Benzene | 0.4 U ^w | µg/L | SW8020 |
| | | Toluene | 4.3 | µg/L | SW8020 |
| | | Ethylbenzene | 2.6 J ^w | µg/L | SW8020 |
| | | Xylenes (Total) | 14 | µg/L | SW8020 |
| | | 1,3,5-Trimethylbenzene | 17 | µg/L | SW8020 |
| | | 1,2,4-Trimethylbenzene | 36 | µg/L | SW8020 |
| | | 1,2,3-Trimethylbenzene | 25 | µg/L | SW8020 |
| MW1-OT45 | 13-Oct-94 | Total Extractable Hydrocarbons | 5 U | mg/L | M8015 |
| | | Total Volatile Hydrocarbons | 1 U | mg/L | M8015 |
| | | Benzene | 0.4 U | µg/L | SW8020 |
| | | Toluene | 4 U | µg/L | SW8020 |
| | | Ethylbenzene | 4 U | µg/L | SW8020 |
| | | Xylenes (Total) | 4 U | µg/L | SW8020 |
| | | 1,3,5-Trimethylbenzene | 4 U | µg/L | SW8020 |
| | | 1,2,4-Trimethylbenzene | 4 U | µg/L | SW8020 |
| | | 1,2,3-Trimethylbenzene | 4 U | µg/L | SW8020 |
| MW2-OT45 | 10-Oct-94 | Total Extractable Hydrocarbons | 20 J | mg/L | M8015 |
| | | Total Volatile Hydrocarbons | 0.5 J | mg/L | M8015 |
| | | Benzene | 0.4 U | µg/L | SW8020 |
| | | Toluene | 4 U | µg/L | SW8020 |
| | | Ethylbenzene | 4 U | µg/L | SW8020 |
| | | Xylenes (Total) | 4 U | µg/L | SW8020 |
| | | 1,3,5-Trimethylbenzene | 4 U | µg/L | SW8020 |
| | | 1,2,4-Trimethylbenzene | 4 U | µg/L | SW8020 |
| | | 1,2,3-Trimethylbenzene | 4 U | µg/L | SW8020 |
| MW3-OT45 | 10-Oct-94 | Total Extractable Hydrocarbons | 5 UJ ^w | mg/L | M8015 |
| | | Total Volatile Hydrocarbons | 1.1 | mg/L | M8015 |
| | | Benzene | 0.4 U | µg/L | SW8020 |
| | | Toluene | 4 U | µg/L | SW8020 |
| | | Ethylbenzene | 4 U | µg/L | SW8020 |
| | | Xylenes (Total) | 4 U | µg/L | SW8020 |
| | | 1,3,5-Trimethylbenzene | 4 U | µg/L | SW8020 |
| | | 1,2,4-Trimethylbenzene | 4 U | µg/L | SW8020 |
| | | 1,2,3-Trimethylbenzene | 4 U | µg/L | SW8020 |
| MW4-OT45 | 13-Oct-94 | Benzene | 0.4 U | µg/L | SW8020 |
| | | Toluene | 4 U | µg/L | SW8020 |
| | | Ethylbenzene | 4 U | µg/L | SW8020 |
| | | Xylenes (Total) | 4 U | µg/L | SW8020 |
| | | 1,3,5-Trimethylbenzene | 4 U | µg/L | SW8020 |
| | | 1,2,4-Trimethylbenzene | 4 U | µg/L | SW8020 |
| | | 1,2,3-Trimethylbenzene | 4 U | µg/L | SW8020 |
| MW5-OT45 | 11-Oct-94 | Benzene | 0.4 U | µg/L | SW8020 |
| | | Toluene | 1.5 J | µg/L | SW8020 |
| | | Ethylbenzene | 6.3 | µg/L | SW8020 |
| | | Xylenes (Total) | 23 | µg/L | SW8020 |
| | | 1,3,5-Trimethylbenzene | 19 | µg/L | SW8020 |
| | | 1,2,4-Trimethylbenzene | 63 | µg/L | SW8020 |
| | | 1,2,3-Trimethylbenzene | 37 | µg/L | SW8020 |
| MW6-OT45 | 30-Sep-94 | Benzene | 0.4 U | µg/L | SW8020 |
| | | Toluene | 0.4 J | µg/L | SW8020 |
| | | Ethylbenzene | 4 U | µg/L | SW8020 |
| | | Xylenes (Total) | 4 U | µg/L | SW8020 |
| | | 1,3,5-Trimethylbenzene | 4 U | µg/L | SW8020 |

TABLE B.7
VALIDATED GROUND WATER DATA FOR SEMIVOLATILE ORGANIC COMPOUNDS
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Analyte | Result | Units | Analytical Method |
|-----------------|-------------|------------------------|--------|-------|-------------------|
| MW2-OT45 | 10-Oct-94 | Benzo(b)fluoranthene | 10 U | µg/L | SW8270 |
| | | Benzo(k)fluoranthene | 10 U | µg/L | SW8270 |
| | | Benzo(a)pyrene | 10 U | µg/L | SW8270 |
| | | Indeno(1,2,3-cd)pyrene | 10 U | µg/L | SW8270 |
| | | Dibenz(a,h)anthracene | 10 U | µg/L | SW8270 |
| | | Benzo(g,h,i)perylene | 10 U | µg/L | SW8270 |
| MW5-OT45 | 11-Oct-94 | Naphthalene | 32 | µg/L | SW8270 |
| | | 2-Methylnaphthalene | 23 | µg/L | SW8270 |
| | | Acenaphthylene | 10 U | µg/L | SW8270 |
| | | Acenaphthene | 1 J | µg/L | SW8270 |
| | | Dibenzofuran | 10 U | µg/L | SW8270 |
| | | Fluorene | 2 J | µg/L | SW8270 |
| | | Phenanthrene | 1 J | µg/L | SW8270 |
| | | Anthracene | 10 U | µg/L | SW8270 |
| | | Fluoranthene | 10 U | µg/L | SW8270 |
| | | Pyrene | 10 U | µg/L | SW8270 |
| | | Benzo(a)anthracene | 10 U | µg/L | SW8270 |
| | | Chrysene | 10 U | µg/L | SW8270 |
| | | Benzo(b)fluoranthene | 10 U | µg/L | SW8270 |
| | | Benzo(k)fluoranthene | 10 U | µg/L | SW8270 |
| | | Benzo(a)pyrene | 10 U | µg/L | SW8270 |
| | | Indeno(1,2,3-cd)pyrene | 10 U | µg/L | SW8270 |
| | | Dibenz(a,h)anthracene | 10 U | µg/L | SW8270 |
| | | Benzo(g,h,i)perylene | 10 U | µg/L | SW8270 |
| MW6-OT45 | 30-Sep-94 | Naphthalene | 10 U | µg/L | SW8270 |
| | | 2-Methylnaphthalene | 10 U | µg/L | SW8270 |
| | | Acenaphthylene | 10 U | µg/L | SW8270 |
| | | Acenaphthene | 10 U | µg/L | SW8270 |
| | | Dibenzofuran | 10 U | µg/L | SW8270 |
| | | Fluorene | 10 U | µg/L | SW8270 |
| | | Phenanthrene | 10 U | µg/L | SW8270 |
| | | Anthracene | 10 U | µg/L | SW8270 |
| | | Fluoranthene | 10 U | µg/L | SW8270 |
| | | Pyrene | 10 U | µg/L | SW8270 |
| | | Benzo(a)anthracene | 10 U | µg/L | SW8270 |
| | | Chrysene | 10 U | µg/L | SW8270 |
| | | Benzo(b)fluoranthene | 10 U | µg/L | SW8270 |
| | | Benzo(k)fluoranthene | 10 U | µg/L | SW8270 |
| | | Benzo(a)pyrene | 10 U | µg/L | SW8270 |
| | | Indeno(1,2,3-cd)pyrene | 10 U | µg/L | SW8270 |
| | | Dibenz(a,h)anthracene | 10 U | µg/L | SW8270 |
| | | Benzo(g,h,i)perylene | 10 U | µg/L | SW8270 |
| MW7-OT45 | 28-Sep-94 | Naphthalene | 64 | µg/L | SW8270 |
| | | 2-Methylnaphthalene | 1 J | µg/L | SW8270 |
| | | Acenaphthylene | 10 U | µg/L | SW8270 |
| | | Acenaphthene | 10 U | µg/L | SW8270 |
| | | Dibenzofuran | 10 U | µg/L | SW8270 |
| | | Fluorene | 10 U | µg/L | SW8270 |

TABLE B.7
VALIDATED GROUND WATER DATA FOR SEMIVOLATILE ORGANIC COMPOUNDS
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Analyte | Result | Units | Analytical Method |
|-----------------|-------------|------------------------|--------|-------|-------------------|
| MW7-OT45 | 28-Sep-94 | Phenanthrene | 10 U | µg/L | SW8270 |
| | | Anthracene | 10 U | µg/L | SW8270 |
| | | Fluoranthene | 10 U | µg/L | SW8270 |
| | | Pyrene | 10 U | µg/L | SW8270 |
| | | Benzo(a)anthracene | 10 U | µg/L | SW8270 |
| | | Chrysene | 10 U | µg/L | SW8270 |
| | | Benzo(b)fluoranthene | 10 U | µg/L | SW8270 |
| | | Benzo(k)fluoranthene | 10 U | µg/L | SW8270 |
| | | Benzo(a)pyrene | 10 U | µg/L | SW8270 |
| | | Indeno(1,2,3-cd)pyrene | 10 U | µg/L | SW8270 |
| | | Dibenz(a,h)anthracene | 10 U | µg/L | SW8270 |
| | | Benzo(g,h,i)perylene | 10 U | µg/L | SW8270 |
| MW8-OT45 | 30-Sep-94 | Naphthalene | 10 U | µg/L | SW8270 |
| | | 2-Methylnaphthalene | 10 U | µg/L | SW8270 |
| | | Acenaphthylene | 10 U | µg/L | SW8270 |
| | | Acenaphthene | 10 U | µg/L | SW8270 |
| | | Dibenzofuran | 10 U | µg/L | SW8270 |
| | | Fluorene | 10 U | µg/L | SW8270 |
| | | Phenanthrene | 10 U | µg/L | SW8270 |
| | | Anthracene | 10 U | µg/L | SW8270 |
| | | Fluoranthene | 10 U | µg/L | SW8270 |
| | | Pyrene | 10 U | µg/L | SW8270 |
| | | Benzo(a)anthracene | 10 U | µg/L | SW8270 |
| | | Chrysene | 10 U | µg/L | SW8270 |
| | | Benzo(b)fluoranthene | 10 U | µg/L | SW8270 |
| | | Benzo(k)fluoranthene | 10 U | µg/L | SW8270 |
| | | Benzo(a)pyrene | 10 U | µg/L | SW8270 |
| | | Indeno(1,2,3-cd)pyrene | 10 U | µg/L | SW8270 |
| | | Dibenz(a,h)anthracene | 10 U | µg/L | SW8270 |
| | | Benzo(g,h,i)perylene | 10 U | µg/L | SW8270 |
| MW10-OT45 | 5-Oct-94 | Naphthalene | 10 U | µg/L | SW8270 |
| | | 2-Methylnaphthalene | 10 U | µg/L | SW8270 |
| | | Acenaphthylene | 10 U | µg/L | SW8270 |
| | | Acenaphthene | 10 U | µg/L | SW8270 |
| | | Dibenzofuran | 10 U | µg/L | SW8270 |
| | | Fluorene | 10 U | µg/L | SW8270 |
| | | Phenanthrene | 10 U | µg/L | SW8270 |
| | | Anthracene | 10 U | µg/L | SW8270 |
| | | Fluoranthene | 10 U | µg/L | SW8270 |
| | | Pyrene | 10 U | µg/L | SW8270 |
| | | Benzo(a)anthracene | 10 U | µg/L | SW8270 |
| | | Chrysene | 10 U | µg/L | SW8270 |
| | | Benzo(b)fluoranthene | 10 U | µg/L | SW8270 |
| | | Benzo(k)fluoranthene | 10 U | µg/L | SW8270 |
| | | Benzo(a)pyrene | 10 U | µg/L | SW8270 |
| | | Indeno(1,2,3-cd)pyrene | 10 U | µg/L | SW8270 |
| | | Dibenz(a,h)anthracene | 10 U | µg/L | SW8270 |
| | | Benzo(g,h,i)perylene | 10 U | µg/L | SW8270 |

TABLE B.7
VALIDATED GROUND WATER DATA FOR SEMIVOLATILE ORGANIC COMPOUNDS
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Analyte | Result | Units | Analytical Method |
|-----------------|-------------|------------------------|--------|-------|-------------------|
| VW1-OT45 | 10-Oct-94 | Naphthalene | 13 | µg/L | SW8270 |
| | | 2-Methylnaphthalene | 41 | µg/L | SW8270 |
| | | Acenaphthylene | 10 U | µg/L | SW8270 |
| | | Acenaphthene | 7 J | µg/L | SW8270 |
| | | Dibenzofuran | 10 U | µg/L | SW8270 |
| | | Fluorene | 9 J | µg/L | SW8270 |
| | | Phenanthrene | 19 | µg/L | SW8270 |
| | | Anthracene | 1 J | µg/L | SW8270 |
| | | Fluoranthene | 10 U | µg/L | SW8270 |
| | | Pyrene | 10 U | µg/L | SW8270 |
| | | Benzo(a)anthracene | 10 U | µg/L | SW8270 |
| | | Chrysene | 10 U | µg/L | SW8270 |
| | | Benzo(b)fluoranthene | 10 U | µg/L | SW8270 |
| | | Benzo(k)fluoranthene | 10 U | µg/L | SW8270 |
| | | Benzo(a)pyrene | 10 U | µg/L | SW8270 |
| | | Indeno(1,2,3-cd)pyrene | 10 U | µg/L | SW8270 |
| | | Dibenz(a,h)anthracene | 10 U | µg/L | SW8270 |
| | | Benzo(g,h,i)perylene | 10 U | µg/L | SW8270 |

^a J= estimated value

^b U= analyte not detected above method detection limit

TABLE B.8
VALIDATED GROUND WATER DATA FOR OTHER RELEVANT ANALYSES
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Analyte | Result | Units | Analytical Method |
|-----------------|-------------|------------------|----------------------|-------|-------------------|
| MPB-OT45 | 10-Oct-94 | Dissolved Oxygen | 0.63 | mg/L | FDO |
| | 12-Oct-94 | Iron | 1.99 | mg/L | H8008 |
| | | Nitrate | 0.9 | mg/L | H8039 |
| | | Sulfate | 39.52 | mg/L | H8051 |
| | | Hydrogen Sulfide | 0.1 | mg/L | H8131 |
| | | Iron, Ferrous | 1.47 | mg/L | H8146 |
| | | Carbon Dioxide | 200 | mg/L | H8223 |
| | | Nitrite | 0.005 U ^a | mg/L | H8507 |
| | | Manganese | 1.3 | mg/L | HMANG |
| MW1-OT45 | 13-Oct-94 | Carbon Dioxide | 132 | mg/L | COU-O2 |
| | | Dissolved Oxygen | 7.52 | mg/L | FDO |
| | | Iron | 0.01 | mg/L | H8008 |
| | | Nitrate | 0.8 | mg/L | H8039 |
| | | Sulfate | 45.5 | mg/L | H8051 |
| | | Hydrogen Sulfide | 0.024 U | mg/L | H8131 |
| | | Iron, Ferrous | 0.02 | mg/L | H8146 |
| | | Carbon Dioxide | 41.25 | mg/L | H8223 |
| | | Nitrite | 0.005 U | mg/L | H8507 |
| | | Manganese | 0.05 U | mg/L | HMANG |
| | | Methane | 0.001 U | mg/L | METHAN |
| MW2-OT45 | 10-Oct-94 | Carbon Dioxide | 209 | mg/L | COU-O2 |
| | | Methane | 0.001 U | mg/L | METHAN |
| MW3-OT45 | 10-Oct-94 | Carbon Dioxide | 48 | mg/L | COU-O2 |
| | | Dissolved Oxygen | 0.5 | mg/L | FDO |
| | | Methane | 0.002 | mg/L | METHAN |
| | 13-Oct-94 | Iron | 0.04 | mg/L | H8008 |
| | | Nitrate | 0.066 U | mg/L | H8039 |
| | | Sulfate | 8.57 | mg/L | H8051 |
| | | Hydrogen Sulfide | 0.024 U | mg/L | H8131 |
| | | Iron, Ferrous | 0.01 | mg/L | H8146 |
| | | Carbon Dioxide | 5 | mg/L | H8223 |
| | | Nitrite | 0.001 | mg/L | H8507 |
| | | Manganese | 0.05 U | mg/L | HMANG |
| MW4-OT45 | 13-Oct-94 | Dissolved Oxygen | 8.71 | mg/L | FDO |
| | | Iron | 0.16 | mg/L | H8008 |
| | | Nitrate | 2.3 | mg/L | H8039 |
| | | Sulfate | 33.3 | mg/L | H8051 |
| | | Hydrogen Sulfide | 0.024 U | mg/L | H8131 |
| | | Iron, Ferrous | 0.04 | mg/L | H8146 |
| | | Carbon Dioxide | 8.75 | mg/L | H8223 |
| | | Nitrite | 0.005 U | mg/L | H8507 |
| | | Manganese | 0.1 | mg/L | HMANG |
| MW5-OT45 | 11-Oct-94 | Dissolved Oxygen | 1.8 | mg/L | FDO |
| | | Iron | 0.74 | mg/L | H8008 |
| | | Nitrate | 0.4 | mg/L | H8039 |
| | | Sulfate | 0.01 U | mg/L | H8051 |
| | | Hydrogen Sulfide | 0.024 U | mg/L | H8131 |
| | | Iron, Ferrous | 0.72 | mg/L | H8146 |

TABLE B.8
VALIDATED GROUND WATER DATA FOR OTHER RELEVANT ANALYSES
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Analyte | Result | Units | Analytical Method |
|-----------------|-------------|------------------|---------|-------|-------------------|
| MW5-OT45 | 11-Oct-94 | Carbon Dioxide | 58.75 | mg/L | H8223 |
| | | Nitrite | 0.026 | mg/L | H8507 |
| | | Manganese | 0.2 | mg/L | HMANG |
| MW6-OT45 | 13-Oct-94 | Dissolved Oxygen | 7.5 | mg/L | FDO |
| | | Iron | 0.92 | mg/L | H8008 |
| | | Nitrate | 0.066 U | mg/L | H8039 |
| | | Sulfate | 34.59 | mg/L | H8051 |
| | | Hydrogen Sulfide | 0.024 U | mg/L | H8131 |
| | | Iron, Ferrous | 0.05 | mg/L | H8146 |
| | | Carbon Dioxide | 8.75 | mg/L | H8223 |
| | | Nitrite | 0.002 | mg/L | H8507 |
| | | Manganese | 0.2 | mg/L | HMANG |
| MW7-OT45 | 12-Oct-94 | Carbon Dioxide | 205 | mg/L | COU-O2 |
| | | Dissolved Oxygen | 0.03 | mg/L | FDO |
| | | Iron | 0.19 | mg/L | H8008 |
| | | Nitrate | 0.3 | mg/L | H8039 |
| | | Sulfate | 24.64 | mg/L | H8051 |
| | | Hydrogen Sulfide | 0.024 U | mg/L | H8131 |
| | | Iron, Ferrous | 0.05 | mg/L | H8146 |
| | | Carbon Dioxide | 27.5 | mg/L | H8223 |
| | | Nitrite | 0.013 | mg/L | H8507 |
| | | Manganese | 1.1 | mg/L | HMANG |
| | | Methane | 0.001 U | mg/L | METHAN |
| MW8-OT45 | 13-Oct-94 | Dissolved Oxygen | 0.61 | mg/L | FDO |
| | | Iron | 0.76 | mg/L | H8008 |
| | | Nitrate | 0.1 | mg/L | H8039 |
| | | Sulfate | 26.94 | mg/L | H8051 |
| | | Hydrogen Sulfide | 0.024 U | mg/L | H8131 |
| | | Iron, Ferrous | 0.07 | mg/L | H8146 |
| | | Carbon Dioxide | 16.25 | mg/L | H8223 |
| | | Nitrite | 0.005 | mg/L | H8507 |
| | | Manganese | 0.6 | mg/L | HMANG |
| MW9-OT45 | 12-Oct-94 | Iron | 0.01 | mg/L | H8008 |
| | | Nitrate | 1.6 | mg/L | H8039 |
| | | Sulfate | 18.75 | mg/L | H8051 |
| | | Hydrogen Sulfide | 0.024 U | mg/L | H8131 |
| | | Iron, Ferrous | 0.02 | mg/L | H8146 |
| | | Carbon Dioxide | 10 | mg/L | H8223 |
| | | Nitrite | 0.005 U | mg/L | H8507 |
| | | Manganese | 0.3 | mg/L | HMANG |
| MW10-OT45 | 5-Oct-94 | Dissolved Oxygen | 0.4 | mg/L | FDO |
| | 11-Oct-94 | Iron | 0.22 | mg/L | H8008 |
| | | Nitrate | 0.1 | mg/L | H8039 |
| | | Sulfate | 6.41 | mg/L | H8051 |
| | | Hydrogen Sulfide | 0.024 U | mg/L | H8131 |
| MW10-OT45 | 11-Oct-94 | Iron, Ferrous | 0.2 | mg/L | H8146 |
| | | Carbon Dioxide | 16.25 | mg/L | H8223 |
| | | Nitrite | 0.002 | mg/L | H8507 |

TABLE B.8
VALIDATED GROUND WATER DATA FOR OTHER RELEVANT ANALYSES
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Analyte | Result | Units | Analytical Method |
|-----------------|-------------|------------------|---------|-------|-------------------|
| MW10-OT45 | 11-Oct-94 | Manganese | 0.05 U | mg/L | HMANG |
| MW11-OT45 | 12-Oct-94 | Dissolved Oxygen | 7.55 | mg/L | FDO |
| | | Iron | 0.024 U | mg/L | H8008 |
| | | Nitrate | 0.4 | mg/L | H8039 |
| | | Sulfate | 18.71 | mg/L | H8051 |
| | | Hydrogen Sulfide | 0.024 U | mg/L | H8131 |
| | | Iron, Ferrous | 0.01 | mg/L | H8146 |
| | | Carbon Dioxide | 12.5 | mg/L | H8223 |
| | | Nitrite | 0.013 | mg/L | H8507 |
| | | Manganese | 0.3 | mg/L | HMANG |
| VW1-OT45 | 10-Oct-94 | Dissolved Oxygen | 1.6 | mg/L | FDO |
| | 12-Oct-94 | Iron | 1.75 | mg/L | H8008 |
| | | Nitrate | 0.8 | mg/L | H8039 |
| | | Sulfate | 16.84 | mg/L | H8051 |
| | | Hydrogen Sulfide | 0.024 U | mg/L | H8131 |
| | | Iron, Ferrous | 1.42 | mg/L | H8146 |
| | | Carbon Dioxide | 38.75 | mg/L | H8223 |
| | | Nitrite | 0.005 | mg/L | H8507 |
| | | Manganese | 0.8 | mg/L | HMANG |

^{a/} U = Analyte Not Detected Above Method Detection Limit

TABLE B.9
GEOCHEMICAL DATA MEASURED IN THE FIELD
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Analyte | Result | Units | Analytical Method |
|-----------------|-------------|-------------------------|------------------------|----------|-------------------|
| MPB-OT45 | 10-Oct-94 | Electrical Conductivity | 0.404 J ^{F29} | mmhos/cm | FCOND |
| | | pH | 6.34 J | pH units | FPH |
| | | Redox potential | 2.85835 J | pE units | FREDOX |
| | | Temperature | 13.4 J | °C | FTEMP |
| | 12-Oct-94 | Alkalinity, Carbonate | 220 J | mg/L | H8221 |
| MW1-OT45 | 13-Oct-94 | Electrical Conductivity | 0.333 J | mmhos/cm | FCOND |
| | | pH | 6.48 J | pH units | FPH |
| | | Redox potential | 2.42224 J | pE units | FREDOX |
| | | Temperature | 14.1 J | °C | FTEMP |
| | | Alkalinity, Carbonate | 100 J | mg/L | H8221 |
| MW3-OT45 | 10-Oct-94 | Electrical Conductivity | 0.17 J | mmhos/cm | FCOND |
| | | pH | 8.7 J | pH units | FPH |
| | 13-Oct-94 | Alkalinity, Carbonate | 80 J | mg/L | H8221 |
| MW4-OT45 | 13-Oct-94 | Electrical Conductivity | 0.255 J | mmhos/cm | FCOND |
| | | pH | 7.29 J | pH units | FPH |
| | | Redox potential | 2.89723 J | pE units | FREDOX |
| | | Temperature | 13.7 J | °C | FTEMP |
| | | Alkalinity, Carbonate | 80 J | mg/L | H8221 |
| MW5-OT45 | 11-Oct-94 | Electrical Conductivity | 0.322 J | mmhos/cm | FCOND |
| | | pH | 7.02 J | pH units | FPH |
| | | Redox potential | 2.94963 J | pE units | FREDOX |
| | | Temperature | 11.8 J | °C | FTEMP |
| | | Alkalinity, Carbonate | 160 J | mg/L | H8221 |
| MW6-OT45 | 13-Oct-94 | Electrical Conductivity | 0.184 J | mmhos/cm | FCOND |
| | | pH | 8.01 J | pH units | FPH |
| | | Redox potential | 2.44929 J | pE units | FREDOX |
| | | Temperature | 13.3 J | °C | FTEMP |
| | | Alkalinity, Carbonate | 80 J | mg/L | H8221 |
| MW7-OT45 | 12-Oct-94 | Electrical Conductivity | 0.556 J | mmhos/cm | FCOND |
| | | pH | 7.16 J | pH units | FPH |
| | | Redox potential | 3.39249 J | pE units | FREDOX |
| | | Temperature | 13.5 J | °C | FTEMP |
| | | Alkalinity, Carbonate | 180 J | mg/L | H8221 |
| MW8-OT45 | 13-Oct-94 | Electrical Conductivity | 0.384 J | mmhos/cm | FCOND |
| | | pH | 7.48 J | pH units | FPH |
| | | Redox potential | 2.69439 J | pE units | FREDOX |
| | | Temperature | 13.1 J | °C | FTEMP |
| | | Alkalinity, Carbonate | 180 J | mg/L | H8221 |
| MW9-OT45 | 12-Oct-94 | Electrical Conductivity | 0.318 J | mmhos/cm | FCOND |
| | | pH | 7.49 J | pH units | FPH |
| | | Redox potential | 4.74814 J | pE units | FREDOX |
| | | Temperature | 13.3 J | °C | FTEMP |
| | | Alkalinity, Carbonate | 160 J | mg/L | H8221 |
| MW10-OT45 | 5-Oct-94 | Electrical Conductivity | 0.265 J | mmhos/cm | FCOND |
| | | pH | 8.05 J | pH units | FPH |
| | | Redox potential | 1.13252 J | pE units | FREDOX |

TABLE B.9
GEOCHEMICAL DATA MEASURED IN THE FIELD
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Analyte | Result | Units | Analytical Method |
|-----------------|-------------|-------------------------|-----------|----------|-------------------|
| MW10-OT45 | 5-Oct-94 | Temperature | 10.8 J | °C | FTEMP |
| | 11-Oct-94 | Alkalinity, Carbonate | 160 J | mg/L | H8221 |
| MW11-OT45 | 12-Oct-94 | Electrical Conductivity | 0.353 J | mmhos/cm | FCOND |
| | | pH | 7.52 J | pH units | FPH |
| | | Redox potential | 4.09398 J | pE units | FREDOX |
| | | Temperature | 13.3 J | °C | FTEMP |
| | | Alkalinity, Carbonate | 180 J | mg/L | H8221 |
| VW1-OT45 | 10-Oct-94 | Electrical Conductivity | 0.309 J | mmhos/cm | FCOND |
| | | pH | 6.82 J | pH units | FPH |
| | | Redox potential | 3.43475 J | pE units | FREDOX |
| | | Temperature | 12.2 J | °C | FTEMP |
| | 12-Oct-94 | Alkalinity, Carbonate | 160 J | mg/L | H8221 |

* J= estimated value

TABLE B.10
QA/QC WATER BLANKS
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT45, WURTSMITH AFB, MICHIGAN

| Sample Type | Sample Date | Matrix |
|--------------------|-------------|--------|
| Equipment Blank | 29-Sep-94 | Water |
| Field Blank | 29-Sep-94 | Water |
| Trip Blank | 06-Oct-94 | Water |
| Trip Blank | 28-Sep-94 | Water |
| Trip Blank | 03-Oct-94 | Water |
| Trip Blank | 14-Oct-94 | Water |
| Water Supply Blank | 29-Sep-94 | Water |

Note:

- 1) Trip blanks were associated by date.
- 2) No samples were qualified due rinsate contamination because no analytes were detected in any of the blanks.

TABLE B.11
DATA VALIDATION QUALIFIER APPLICATION
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITEOT45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Analyte | Matrix | Analytical Method | Laboratory Result ^{a/} | Holding Time Flag ^{b/} | Method Blank Flag ^{c/} | PQL Flag ^{d/} | Final Report |
|-----------------|------------------------|--------------------------------|---------------|-------------------|---------------------------------|---------------------------------|---------------------------------|------------------------|--------------|
| DC-OT45 | 28-Sep-94 | Total Extractable Hydrocarbons | Drill Cutting | M8015 | = | J | | | J |
| | | Ethylbenzene | Drill Cutting | SW8020 | = | | | J | J |
| | | Acenaphthene | Drill Cutting | SW8270 | = | | | J | J |
| | | Dibenzofuran | Drill Cutting | SW8270 | = | | | J | J |
| | | Fluorene | Drill Cutting | SW8270 | = | | | J | J |
| | | Pyrene | Drill Cutting | SW8270 | = | | | J | J |
| MPA-OT45 | 28-Sep-94 07-Oct-94 | Total Extractable Hydrocarbons | Soil | M8015 | ND | J | | | UJ |
| | | Toluene | Soil | SW8020 | = | | | J | J |
| | | Benzo(a)anthracene | Soil | SW8270 | = | | | J | J |
| | | Benzo(a)pyrene | Soil | SW8270 | = | | | J | J |
| | | Benzo(b)fluoranthene | Soil | SW8270 | = | | | J | J |
| | | Benzo(g,h,i)perylene | Soil | SW8270 | = | | | J | J |
| | | Benzo(k)fluoranthene | Soil | SW8270 | = | | | J | J |
| | | Chrysene | Soil | SW8270 | = | | | J | J |
| | | Fluoranthene | Soil | SW8270 | = | | | J | J |
| | | Indeno(1,2,3-cd)pyrene | Soil | SW8270 | = | | | J | J |
| | | Pyrene | Soil | SW8270 | = | | | J | J |
| | | Total Extractable Hydrocarbons | Soil | M8015 | = | | | | J |
| | | Ethylbenzene | Soil | SW8020 | = | | | J | J |
| | | Benzo(a)anthracene | Soil | SW8270 | = | | | J | J |
| MPB-OT45 | 28-Sep-94 07-Oct-94 | Benzo(a)pyrene | Soil | SW8270 | = | J | | J | J |
| | | Benzo(b)fluoranthene | Soil | SW8270 | = | | | J | J |
| | | Chrysene | Soil | SW8270 | = | | | J | J |
| | | Fluoranthene | Soil | SW8270 | = | | | J | J |
| | | Pyrene | Soil | SW8270 | = | | | J | J |
| | | Pyrene | Soil | SW8270 | = | | | J | J |
| | | Pyrene | Soil | SW8270 | = | | | J | J |
| | | Pyrene | Soil | SW8270 | = | | | J | J |

TABLE B.11
DATA VALIDATION QUALIFIER APPLICATION
REMEDIATION ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Analyte | Matrix | Analytical Method | Laboratory Result ^{a/} | Holding Time Flag ^{b/} | Method Blank Flag ^{c/} | PQL Flag ^{d/} | Final Report |
|-----------------|-------------|--------------------------------|--------|-------------------|---------------------------------|---------------------------------|---------------------------------|------------------------|--------------|
| MW10-OT45 | 03-Oct-94 | 1,2,3-Trimethylbenzene | Soil | SW8020 | ND | J | | | UJ |
| | | 1,2,4-Trimethylbenzene | Soil | SW8020 | ND | J | | | UJ |
| | | 1,3,5-Trimethylbenzene | Soil | SW8020 | ND | J | | | UJ |
| | | Benzene | Soil | SW8020 | ND | J | | | UJ |
| | | Ethylbenzene | Soil | SW8020 | ND | J | | | UJ |
| | | Toluene | Soil | SW8020 | = | | U | J | U |
| | | Toluene | Soil | SW8020 | ND | J | | J | UJ |
| | | Xylenes (Total) | Soil | SW8020 | = | | U | J | U |
| | | Xylenes (Total) | Soil | SW8020 | ND | J | | | UJ |
| | | Xylenes (Total) | Soil | SW8020 | ND | J | | | UJ |
| MW5-OT45 | 29-Sep-94 | 1,2,3-Trimethylbenzene | Soil | SW8020 | = | J | | | J |
| | | 1,2,4-Trimethylbenzene | Soil | SW8020 | = | J | | | J |
| | | 1,3,5-Trimethylbenzene | Soil | SW8020 | = | J | | | J |
| | | Acenaphthene | Soil | SW8270 | = | | | J | J |
| | | Pyrene | Soil | SW8270 | = | | | J | J |
| | | Pyrene | Soil | SW8270 | = | | | J | J |
| MW6-OT45 | 29-Sep-94 | Toluene | Soil | SW8020 | = | | U | J | U |
| | | Xylenes (Total) | Soil | SW8020 | = | | U | J | U |
| MW7-OT45 | 27-Sep-94 | Total Extractable Hydrocarbons | Soil | M8015 | = | J | | J | J |
| | | 1,2,3-Trimethylbenzene | Soil | SW8020 | ND | J | | | UJ |
| | | 1,2,4-Trimethylbenzene | Soil | SW8020 | ND | J | | | UJ |
| | | 1,3,5-Trimethylbenzene | Soil | SW8020 | = | J | | J | J |
| | | Benzene | Soil | SW8020 | ND | J | | | UJ |
| | | Ethylbenzene | Soil | SW8020 | ND | J | | | UJ |
| | | Toluene | Soil | SW8020 | = | J | U | J | UJ |
| | | Xylenes (Total) | Soil | SW8020 | = | J | U | J | UJ |
| | | Xylenes (Total) | Soil | SW8020 | = | J | | | UJ |
| | | Xylenes (Total) | Soil | SW8020 | = | J | | | UJ |
| MW9-OT45 | 29-Sep-94 | 1,2,3-Trimethylbenzene | Soil | SW8020 | = | | | J | J |
| | | 1,2,4-Trimethylbenzene | Soil | SW8020 | = | | | J | J |

TABLE B.11
DATA VALIDATION QUALIFIER APPLICATION
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Analyte | Matrix | Analytical Method | Laboratory Result ^a | Holding Time Flag ^b | Method Blank Flag ^c | PQL Flag ^d | Final Report |
|-----------------|-------------|--------------------------------|--------|-------------------|--------------------------------|--------------------------------|--------------------------------|-----------------------|--------------|
| MW9-OT45 | 29-Sep-94 | Xylenes (Total) | Soil | SW8020 | = | | U | J | U |
| VW1-OT45 | 28-Sep-94 | Total Extractable Hydrocarbons | Soil | M8015 | = | J | | J | J |
| | | 1,3,5-Trimethylbenzene | Soil | SW8020 | = | | | J | J |
| | | Toluene | Soil | SW8020 | = | | U | J | U |
| | | Xylenes (Total) | Soil | SW8020 | = | | U | J | U |
| MPB-OT45 | 10-Oct-94 | Ethylbenzene | Water | SW8020 | = | | | J | J |
| | | Acenaphthene | Water | SW8270 | = | | | J | J |
| | | Anthracene | Water | SW8270 | = | | | J | J |
| | | Fluorene | Water | SW8270 | = | | | J | J |
| | | Naphthalene | Water | SW8270 | = | | | J | J |
| | | Phenanthrene | Water | SW8270 | = | | | J | J |
| MW1-OT45 | 13-Oct-94 | Iron | Water | H8008 | = | | | J | J |
| | | Iron, Ferrous | Water | H8146 | = | | | J | J |
| MW10-OT45 | 11-Oct-94 | Nitrite | Water | H8507 | = | | | J | J |
| | 05-Oct-94 | Toluene | Water | SW8020 | = | | | J | J |
| | | Xylenes (Total) | Water | SW8020 | = | | U | J | U |
| MW11-OT45 | 12-Oct-94 | Iron, Ferrous | Water | H8146 | = | | | J | J |
| | | Nitrite | Water | H8507 | = | | | J | J |
| | | Benzene | Water | SW8020 | = | | | J | J |
| | | Benzene | Water | SW8240 | = | | | J | J |
| MW2-OT45 | 10-Oct-94 | Total Extractable Hydrocarbons | Water | M8015 | = | J | | | J |
| | | Total Volatile Hydrocarbons | Water | M8015 | = | | U | J | J |
| | | Xylenes (Total) | Water | SW8020 | = | | | J | U |
| | | Anthracene | Water | SW8270 | = | | | J | J |
| MW3-OT45 | 13-Oct-94 | Iron | Water | H8008 | = | | | J | J |
| | | Iron, Ferrous | Water | H8146 | = | | | J | J |

TABLE B.11
DATA VALIDATION QUALIFIER APPLICATION
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Analyte | Matrix | Analytical Method | Laboratory Result ^d | Holding Time Flag ^b | Method Blank Flag ^c | PQL Flag ^w | Final Report |
|-----------------|------------------------|--------------------------------|--------|-------------------|--------------------------------|--------------------------------|--------------------------------|-----------------------|--------------|
| MW3-OT45 | 13-Oct-94 | Nitrite | Water | H8507 | = | | | J | J |
| | | Total Extractable Hydrocarbons | Water | M8015 | ND | J | | | UJ |
| | | Methane | Water | RSK175 | = | | | J | J |
| MW4-OT45 | 13-Oct-94 | Iron, Ferrous | Water | H8146 | = | | | J | J |
| MW5-OT45 | 11-Oct-94 | Nitrite | Water | H8507 | = | | | J | J |
| | | Toluene | Water | SW8020 | = | | | J | J |
| | | Acenaphthene | Water | SW8270 | = | | | J | J |
| | | Fluorene | Water | SW8270 | = | | | J | J |
| | | Phenanthrene | Water | SW8270 | = | | | J | J |
| MW6-OT45 | 13-Oct-94 30-Sep-94 | Nitrite | Water | H8507 | = | | | J | J |
| | | Toluene | Water | SW8020 | = | | | J | J |
| MW7-OT45 | 12-Oct-94 28-Sep-94 | Nitrite | Water | H8507 | = | | | J | J |
| | | 1,3,5-Trimethylbenzene | Water | SW8020 | = | | | J | J |
| | | Benzene | Water | SW8020 | = | | | J | J |
| | | Ethylbenzene | Water | SW8020 | = | | | J | J |
| | | Toluene | Water | SW8020 | = | | | J | J |
| | | Xylenes (Total) | Water | SW8020 | = | | | J | J |
| MW8-OT45 | 13-Oct-94 | 2-Methylnaphthalene | Water | SW8270 | = | | | J | J |
| | | Nitrite | Water | H8507 | = | | | J | J |
| MW9-OT45 | 12-Oct-94 | Iron | Water | H8008 | = | | | J | J |
| | | Iron, Ferrous | Water | 118146 | = | | | J | J |
| VW1-OT45 | 12-Oct-94 10-Oct-94 | Nitrite | Water | H8507 | = | | | J | J |
| | | Toluene | Water | SW8020 | = | | | J | J |
| | | Acenaphthene | Water | SW8270 | = | | | J | J |
| | | Anthracene | Water | SW8270 | = | | | J | J |
| | | Fluorene | Water | SW8270 | = | | | J | J |

TABLE B.11
DATA VALIDATION QUALIFIER APPLICATION
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITEOT45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Analyte | Matrix | Analytical Method | Laboratory Result ^{a/} | Holding Time Flag ^{b/} | Method Blank Flag ^{c/} | PQL Flag ^{d/} | Final Report |
|-----------------|-------------|---------|--------|-------------------|---------------------------------|---------------------------------|---------------------------------|------------------------|--------------|
|-----------------|-------------|---------|--------|-------------------|---------------------------------|---------------------------------|---------------------------------|------------------------|--------------|

^{a/} = Result reported by analytical laboratory. ND = not detected. "-" = An real value was reported.

^{b/} = A flag was applied to the data because sample holding time was exceeded.

^{c/} = A flag was applied because an analyte was detected during the analysis of a method blank.

^{d/} = A flag was applied because the reported value was above the MDL and below the PQL.

TABLE B.12
DUPLICATE AND REPLICATE SAMPLE RESULTS
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Matrix | Analytical Method | Sample Interval (ft bgs: beginning-ending) | Analyte | Real Sample Result | Duplicate Sample Result | Units | RPD ^a |
|-----------------|-------------|---------------|-------------------|--|------------------------|--------------------|-------------------------|-------|------------------|
| MPB-OT45 | 11-Oct-94 | Soil Gas | TO3 | 9 - 9.5 | Benzene | 0.017 U | 0.017 U | µg/L | |
| | | | TO3 | 9 - 9.5 | Toluene | 0.02 U | 0.02 U | µg/L | |
| | | | TO3 | 9 - 9.5 | Ethylbenzene | 1.4 | 1.7 | µg/L | 9.68 |
| | | | TO3 | 9 - 9.5 | Petroleum Hydrocarbons | 2100 | 2100 | µg/L | 0.00 |
| | | | TO3 | 9 - 9.5 | Xylenes (Total) | 3.2 | 3.4 | µg/L | 3.03 |
| VW1-OT45 | 08-Oct-94 | Soil Gas | TO3 | 5 - 10 | Benzene | 0.006 U | 0.006 U | µg/L | |
| | | | TO3 | 5 - 10 | Toluene | 0.008 U | 0.008 U | µg/L | |
| | | | TO3 | 5 - 10 | Ethylbenzene | 0.26 | 0.3 | µg/L | 7.14 |
| | | | TO3 | 5 - 10 | Petroleum Hydrocarbons | 910 | 910 | µg/L | 0.00 |
| | | | TO3 | 5 - 10 | Xylenes (Total) | 1 | 1.2 | µg/L | 9.09 |
| MW2-OT45 | 18-Oct-94 | Soil Gas Flux | TO3 | 0 - 0 | Benzene | 0.007 U | 0.007 U | µg/L | |
| | | | TO3 | 0 - 0 | Toluene | 0.023 | 0.015 | µg/L | 21.05 |
| | | | TO3 | 0 - 0 | Ethylbenzene | 0.009 U | 0.009 U | µg/L | |
| | | | TO3 | 0 - 0 | Petroleum Hydrocarbons | 3.1 | 2.5 | µg/L | 10.71 |
| | | | TO3 | 0 - 0 | Xylenes (Total) | 0.009 U | 0.009 U | µg/L | |
| MW10-OT45 | 03-Oct-94 | Soil | SW8020 | 9 - 11 | Benzene | 0.46 U | 0.4 U | µg/kg | |
| | | | SW8020 | 9 - 11 | Toluene | 4.6 U | 4 U | µg/kg | |
| | | | SW8020 | 9 - 11 | Ethylbenzene | 4.6 U | 4 U | µg/kg | |
| | | | SW8020 | 9 - 11 | 1,2,3-Trimethylbenzene | 4.6 U | 4 U | µg/kg | |
| | | | SW8020 | 9 - 11 | 1,2,4-Trimethylbenzene | 4.6 U | 4 U | µg/kg | |
| | | | SW8020 | 9 - 11 | 1,3,5-Trimethylbenzene | 4.6 U | 4 U | µg/kg | |
| | | | SW8020 | 9 - 11 | Xylenes (Total) | 4.6 U | 4 U | µg/kg | |
| | | | SW8270 | 9 - 11 | Acenaphthene | 380 U | 350 U | µg/kg | |
| | | | SW8270 | 9 - 11 | Acenaphthylene | 380 U | 350 U | µg/kg | |
| | | | SW8270 | 9 - 11 | Anthracene | 380 U | 350 U | µg/kg | |
| | | | SW8270 | 9 - 11 | Benzo(a)anthracene | 380 U | 350 U | µg/kg | |
| | | | SW8270 | 9 - 11 | Benzo(a)pyrene | 380 U | 350 U | µg/kg | |
| | | | SW8270 | 9 - 11 | Benzo(b)fluoranthene | 380 U | 350 U | µg/kg | |
| | | | SW8270 | 9 - 11 | | | | | |

TABLE B.12
DUPLICATE AND REPLICATE SAMPLE RESULTS
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Matrix | Analytical Method | Sample Interval (ft bgs: beginning-ending) | Analyte | Real Sample Result | Duplicate Sample Result | Units | RPD ^{a/} |
|-----------------|-------------|--------|-------------------|---|------------------------|--------------------|-------------------------|-------|-------------------|
| MW10-OT45 | 03-Oct-94 | Soil | SW8270 | 9 - 11 | Benzo(g,h,i)perylene | 380 U | 350 U | µg/kg | |
| | | | SW8270 | 9 - 11 | Benzo(k)fluoranthene | 380 U | 350 U | µg/kg | |
| | | | SW8270 | 9 - 11 | Chrysene | 380 U | 350 U | µg/kg | |
| | | | SW8270 | 9 - 11 | Dibenz(a,h)anthracene | 380 U | 350 U | µg/kg | |
| | | | SW8270 | 9 - 11 | Dibenzofuran | 380 U | 350 U | µg/kg | |
| | | | SW8270 | 9 - 11 | Fluorene | 380 U | 350 U | µg/kg | |
| | | | SW8270 | 9 - 11 | Fluoranthene | 380 U | 350 U | µg/kg | |
| | | | SW8270 | 9 - 11 | Indeno(1,2,3-cd)pyrene | 380 U | 350 U | µg/kg | |
| | | | SW8270 | 9 - 11 | 2-Methylnaphthalene | 380 U | 350 U | µg/kg | |
| | | | SW8270 | 9 - 11 | Naphthalene | 380 U | 350 U | µg/kg | |
| | | | SW8270 | 9 - 11 | Phenanthrene | 380 U | 350 U | µg/kg | |
| | | | SW8270 | 9 - 11 | Pyrene | 380 U | 350 U | µg/kg | |

^{a/} RPD = relative percent difference between real and duplicate sample.

TABLE B.13
DETECTED ANALYTES IN GROUNDWATER FOR VOLATILE ORGANIC
COMPOUND AND SEMIVOLATILE COMPOUND ANALYSES
(1995 DETECTED ANALYTES ONLY)
REMEDIATION ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT-45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Analyte | Result | Units | Analytical Method |
|-----------------|-------------|----------------------------|--------|-------|-------------------|
| OT45-MW11 | 17-Oct-95 | Benzene | 1.3 | µg/L | SW8020 |
| | | 1,2,3,4-Tetramethylbenzene | 2.9 | µg/L | SW8020 |
| OT45-MW11 | 17-Oct-95 | Benzene | 1.1 | µg/L | SW8260 |
| | | 1,2,3,4-Tetramethylbenzene | 4.3 | µg/L | SW8260 |
| OT45-MW11 | 17-Oct-95 | Naphthalene | 1 | µg/L | SW8270 |
| OT45-MW5 | 17-Oct-95 | Ethyl Benzene | 5.0 | µg/L | SW8020 |
| | | Total Xylenes (m,p & o) | 11 | µg/L | SW8020 |
| | | 1,3,5-Trimethylbenzene | 4.3 | µg/L | SW8020 |
| | | 1,2,4-Trimethylbenzene | 15 | µg/L | SW8020 |
| | | 1,2,3-Trimethylbenzene | 7.3 | µg/L | SW8020 |
| | | 1,2,3,4-Tetramethylbenzene | 13 | µg/L | SW8020 |
| OT45-MW7 | 17-Oct-95 | Benzene | 1.3 | µg/L | SW8020 |
| | | Ethyl Benzene | 11 | µg/L | SW8020 |
| | | Total Xylenes (m,p & o) | 1.2 | µg/L | SW8020 |
| | | 1,3,5-Trimethylbenzene | 5.4 | µg/L | SW8020 |
| | | 1,2,4-Trimethylbenzene | 1.8 | µg/L | SW8020 |
| | | 1,2,3-Trimethylbenzene | 1.8 | µg/L | SW8020 |
| | | 1,2,3,4-Tetramethylbenzene | 26 | µg/L | SW8020 |
| OT45-MW12 | 17-Oct-95 | Ethyl Benzene | 2.8 | µg/L | SW8020 |
| | | Total Xylenes (m,p & o) | 5.4 | µg/L | SW8020 |
| | | 1,3,5-Trimethylbenzene | 2.3 | µg/L | SW8020 |
| | | 1,2,4-Trimethylbenzene | 7.6 | µg/L | SW8020 |
| | | 1,2,3-Trimethylbenzene | 4.4 | µg/L | SW8020 |
| | | 1,2,3,4-Tetramethylbenzene | 7.4 | µg/L | SW8020 |
| OT45-MW12 | 17-Oct-95 | Naphthalene | 18 | µg/L | SW8270 |
| OT45-MW4 | 17-Oct-95 | 1,2,3-Trimethylbenzene | 0.8 | µg/L | SW8020 |
| OT45-MW10 | 18-Oct-95 | Total Xylenes (m,p & o) | 1.3 | µg/L | SW8020 |
| OT45-MPB | 18-Oct-95 | Ethyl Benzene | 0.6 | µg/L | SW8020 |
| | | Total Xylenes (m,p & o) | 2.6 | µg/L | SW8020 |
| | | 1,2,4-Trimethylbenzene | 1.5 | µg/L | SW8020 |
| | | 1,2,3-Trimethylbenzene | 1.3 | µg/L | SW8020 |
| | | 1,2,3,4-Tetramethylbenzene | 2.1 | µg/L | SW8020 |
| OT45-VW1 | 18-Oct-95 | Ethyl Benzene | 0.8 | µg/L | SW8020 |
| | | Total Xylenes (m,p & o) | 3.2 | µg/L | SW8020 |
| | | 1,3,5-Trimethylbenzene | 2.4 | µg/L | SW8020 |
| | | 1,2,4-Trimethylbenzene | 6.4 | µg/L | SW8020 |
| | | 1,2,3-Trimethylbenzene | 2.3 | µg/L | SW8020 |
| | | 1,2,3,4-Tetramethylbenzene | 9.4 | µg/L | SW8020 |

TABLE B.13 (Continued)
DETECTED ANALYTES IN GROUNDWATER FOR VOLATILE ORGANIC
COMPOUND AND SEMIVOLATILE COMPOUND ANALYSES
(1995 DETECTED ANALYTES ONLY)
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT-45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Analyte | Result | Units | Analytical Method |
|-----------------|-------------|----------------------------|--------|-------|-------------------|
| OT45-MW2 | 18-Oct-95 | Toluene | 1.8 | µg/L | SW8020 |
| | | Ethyl Benzene | 10 | µg/L | SW8020 |
| | | Total Xylenes (m,p & o) | 21 | µg/L | SW8020 |
| | | 1,3,5-Trimethylbenzene | 8.7 | µg/L | SW8020 |
| | | 1,2,4-Trimethylbenzene | 48 | µg/L | SW8020 |
| | | 1,2,3-Trimethylbenzene | 26 | µg/L | SW8020 |
| | | 1,2,3,4-Tetramethylbenzene | 66 | µg/L | SW8020 |
| OT45-BP4 | 18-Oct-95 | Toluene | 1.9 | µg/L | SW8020 |
| | | Ethyl Benzene | 0.6 | µg/L | SW8020 |
| | | Total Xylenes (m,p & o) | 2.1 | µg/L | SW8020 |
| OT45-BP1 | 18-Oct-95 | Toluene | 3.9 | µg/L | SW8020 |
| | | Total Xylenes (m,p & o) | 1.2 | µg/L | SW8020 |
| | | 1,2,3,4-Tetramethylbenzene | 1.2 | µg/L | SW8020 |
| OT45-BP2 | 18-Oct-95 | Benzene | 0.5 | µg/L | SW8020 |
| | | Toluene | 4.2 | µg/L | SW8020 |
| OT45-BP3 | 18-Oct-95 | Toluene | 6.7 | µg/L | SW8020 |
| | | Ethyl Benzene | 1.5 | µg/L | SW8020 |
| | | Total Xylenes (m,p & o) | 9.8 | µg/L | SW8020 |
| | | 1,3,5-Trimethylbenzene | 0.7 | µg/L | SW8020 |
| | | 1,2,4-Trimethylbenzene | 1.7 | µg/L | SW8020 |
| OT45-VW1 | 18-Oct-95 | Naphthalene | 22 | µg/L | SW8270 |
| OT45-MW2 | 18-Oct-95 | Naphthalene | 130 | µg/L | SW8270 |
| | | Phenanthrene | 6 | µg/L | SW8270 |
| OT45-MW5 | 17-Oct-95 | Naphthalene | 11 | µg/L | SW8270 |

TABLE B.14
DETECTED ANALYTES IN GROUNDWATER FOR VOLATILE ORGANIC
COMPOUND AND SEMIVOLATILE COMPOUND ANALYSES
(1996 - 1997 DETECTED ANALYTES ONLY)
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT-45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Analyte | Result | Units | Analytical Method |
|-----------------|-------------|----------------------------|--------|-------|-------------------|
| OT45-MW7 | 6-Nov-96 | Trichloroethene | 3J | µg/L | SW8260 |
| | | Ethyl Benzene | 7 | µg/L | SW8260 |
| | | Total Xylenes (m,p & o) | 2J | µg/L | SW8260 |
| | | 1,3,5-Trimethylbenzene | 6 | µg/L | SW8260 |
| | | 1,2,4-Trimethylbenzene | 1J | µg/L | SW8260 |
| | | 1,2,3-Trimethylbenzene | 1J | µg/L | SW8260 |
| OT45-MW2 | 24-Jun-97 | 1,2,3,4-Tetramethylbenzene | 7.4 | µg/L | SW8260? |

J = indicates a laboratory estimated value; compound was detected, but below the laboratory reporting limit or estimated quantitation limit.

TABLE B.14a

POSITIVE DETECTIONS OF TARGET ANALYTES IN 1997 GROUNDWATER SAMPLES
RCRA CLOSURE OF DRMO FACILITY
WURTSMITH AFB, OSCODA, MICHIGAN

| SAMPLE LOCATION | DATE SAMPLED | ANALYTE (ug/l) | | | | | | |
|--------------------------------------|-----------------|----------------|-------------|-----------------|-----------------|------------------------|------------------------|------------|
| | | ETHYLBENZENE | NAPHTHALENE | n-PROPYLBENZENE | TRICHLOROETHENE | 1,2,4-TRIMETHYLBENZENE | 1,3,5-TRIMETHYLBENZENE | m,p-XYLENE |
| ACTION LEVEL (307) ¹ | -- | 74 | 250 | 2 | 2.2 | 5 | 23 | 280 |
| ACTION LEVEL (201 Res.) ² | -- | 74 | 250 | 2 | 5 | 35 | 65 | 280 |
| ACTION LEVEL (201 Ind.) ³ | -- | 74 | 750 | 2 | 5 | 55 | 65 | 280 |
| MW02 | 11/5/97 | 4 | 98 | 2 | 2 | 41 | 4 | 6 |
| MW11 | 11/5/97 | <1 | 5 | <1 | 8 | <1 | <1 | <2 |
| TW01 | 11/5/97 | <1 | <5 | <1 | <1 | <1 | <1 | <2 |
| TW04 | 11/5/97 | <1 | <5 | <1 | 1 | <1 | <1 | <2 |
| TW11 | 11/5/97 | <1 | <5 | <1 | 1 | <1 | <1 | <2 |
| TW11-DUP | 11/5/97 | <1 | <5 | <1 | <1 | <1 | <1 | <2 |
| TW12 | 11/5/97 | <1 | <5 | <1 | <1 | <1 | <1 | <2 |
| TRIP BLANK | 11/5/97 | <1 | <5 | <1 | <1 | <1 | <1 | <2 |
| RINSATE BLANK | 11/5/97 | <1 | <5 | <1 | <1 | <1 | <1 | <2 |
| FIELD BLANK | 11/5/97 | <1 | <5 | <1 | <1 | <1 | <1 | <2 |

NOTES:

< - Analyte Not Detected at Reported Quantitation Limit.

DUP - Duplicate Sample.

1 - Action Level Selected From MERA Operational Memorandum #8, Revision 3 (February 4, 1994).

2 - Action Level Selected From Interim Environmental Response Division
Operational Memorandum #8, Revision 4 (June 5, 1995).

TABLE B.15
QA/QC WATER BLANKS
(1996 - 1997)
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT-45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Sample Type/Analyte | Result | Units | Analytical Method |
|-----------------------|-------------|----------------------------|-----------------|-------|-------------------|
| OT45-MW7 | 6-Nov-96 | Equipment Blank | | | |
| | | Trichloroethene | U | µg/L | SW8260 |
| | | Ethyl Benzene | U | µg/L | SW8260 |
| | | Total Xylenes (m,p & o) | U | µg/L | SW8260 |
| | | 1,3,5-Trimethylbenzene | U | µg/L | SW8260 |
| | | 1,2,4-Trimethylbenzene | U | µg/L | SW8260 |
| | | 1,2,3-Trimethylbenzene | U | µg/L | SW8260 |
| OT45-MW7 | 6-Nov-96 | Trip Blank | | | |
| | | Trichloroethene | U | µg/L | SW8260 |
| | | Ethyl Benzene | U | µg/L | SW8260 |
| | | Total Xylenes (m,p & o) | U | µg/L | SW8260 |
| | | 1,3,5-Trimethylbenzene | U | µg/L | SW8260 |
| | | 1,2,4-Trimethylbenzene | U | µg/L | SW8260 |
| | | 1,2,3-Trimethylbenzene | U | µg/L | SW8260 |
| OT45-MW7 | 6-Nov-96 | Matrix Spike | | | |
| | | Trichloroethene | 22 | µg/L | SW8260 |
| | | Ethyl Benzene | 28 | µg/L | SW8260 |
| | | Total Xylenes (m,p & o) | 21 | µg/L | SW8260 |
| | | 1,3,5-Trimethylbenzene | -- ¹ | µg/L | SW8260 |
| | | 1,2,4-Trimethylbenzene | -- ¹ | µg/L | SW8260 |
| | | 1,2,3-Trimethylbenzene | -- ¹ | µg/L | SW8260 |
| OT45-MW2 | 6-Nov-96 | Matrix Spike Duplicate | | | |
| | | Trichloroethene | 18 | µg/L | SW8260 |
| | | Ethyl Benzene | 20 | µg/L | SW8260 |
| | | Total Xylenes (m,p & o) | 20 | µg/L | SW8260 |
| | | 1,3,5-Trimethylbenzene | 20 | µg/L | SW8260 |
| | | 1,2,4-Trimethylbenzene | 20 | µg/L | SW8260 |
| | | 1,2,3-Trimethylbenzene | 19 | µg/L | SW8260 |
| OT45-EB10 | 24-Jun-97 | Equipment Blank | | | |
| | | 1,2,3,4-Tetramethylbenzene | U | µg/L | SW8260 |
| OT45 | 24-Jun-97 | Trip Blank | | | |
| | | 1,2,3,4-Tetramethylbenzene | U | µg/L | SW8260 |
| OT45-VW1 ² | 24-Jun-97 | Matrix Spike Duplicate | | | |
| | | 1,2,3,4-Tetramethylbenzene | 20 | µg/L | SW8260 |

U = compound analyzed for, but not detected above reporting limits. Reporting limits are roughly the method detection limits for reagent water.

¹— matrix spike analyses were not performed for the methylbenzenes using OT45-MW7 sample data.

²— no matrix spike analyses was performed using MW2 sample information.

TABLE B.16
DETECTED ANALYTES IN SOIL FOR VOLATILE ORGANIC COMPOUND
AND SEMIVOLATILE COMPOUND ANALYSES
(1996 DETECTED ANALYTES ONLY)
REMEDIAL ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT-45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Analyte | Result | Units | Analytical Method |
|-----------------|-------------|----------------------------|--------|-------|-------------------|
| C1 | 27-Jul-96 | Toluene | 0.9J | µg/kg | SW8020 |
| | | Total Xylenes (m,p & o) | 1J | µg/kg | SW8020 |
| C2 | 27-Jul-96 | 1,2,3,4-Tetramethylbenzene | 0.7J | µg/kg | SW8020 |
| C3 | 27-Jul-96 | Toluene | 0.8J | µg/kg | SW8020 |
| | | Total Xylenes (m, p & o) | 0.7J | µg/kg | SW8020 |
| | | Pyrene | 58J | µg/kg | SW8270 |
| C4 | 28-Jul-96 | Pyrene | 34J | µg/kg | SW8270 |
| C7 | 28-Jul-96 | Ethylbenzene | 0.6J | µg/kg | SW8020 |
| | | Total Xylenes (m, p & o) | 2.3J | µg/kg | SW8020 |
| | | 1,2,3-Trimethylbenzene | 1.3J | µg/kg | SW8020 |
| | | 1,2,4-Trimethylbenzene | 2.7J | µg/kg | SW8020 |
| | | 1,3,5-Trimethylbenzene | 2.3J | µg/kg | SW8020 |
| | | 1,2,3,4-Tetramethylbenzene | 30 | µg/kg | SW8020 |
| | | 2-Methylnaphthalene | 47J | µg/kg | SW8270 |
| | | Naphthalene | 35J | µg/kg | SW8270 |
| | | Phenanthrene | 21J | µg/kg | SW8270 |
| C8 | 28-Jul-96 | Pyrene | 58J | µg/kg | SW8270 |
| | | 1,3,5-Trimethylbenzene | 0.7J | µg/kg | SW8020 |
| C10 | 28-Jul-96 | 2-Methylnaphthalene | 110J | µg/kg | SW8270 |
| | | Total Xylenes (m, p & o) | 0.6J | µg/kg | SW8020 |
| C13 | 4-Aug-96 | 1,3,5-Trimethylbenzene | 0.5J | µg/kg | SW8020 |
| | | Total Xylenes (m, p & o) | 0.6J | µg/kg | SW8020 |
| C14 | 4-Aug-96 | 1,3,5-Trimethylbenzene | 0.5J | µg/kg | SW8020 |
| | | Total Xylenes (m, p & o) | 0.5J | µg/kg | SW8020 |
| C14 | 4-Aug-96 | 1,2,3,4-Tetramethylbenzene | 1.0J | µg/kg | SW8020 |
| | | Total Xylenes (m, p & o) | 0.5J | µg/kg | SW8020 |

J = indicates a laboratory estimated value; compound was detected, but below the laboratory reporting limit or estimated quantitation limit.

TABLE B.17
QA/QC SOIL BLANKS
(1996)
REMEDIATION ACTION PLAN
RISK-BASED APPROACH TO REMEDIATION
SITE OT-45, WURTSMITH AFB, MICHIGAN

| Sample Location | Sample Date | Sample Type/Analyte | Result | Units | Matrix |
|-----------------|-------------|----------------------------|--------|-------|--------|
| OT45-R1 | 4-Aug-96 | Replicate | | | Water |
| | | Benzene | U | µg/L | |
| | | Ethyl Benzene | U | µg/L | |
| | | Toluene | U | µg/L | |
| | | Total Xylenes (m,p & o) | U | µg/L | |
| | | Chlorobenzene | U | µg/L | |
| | | 1,3,5-Trimethylbenzene | U | µg/L | |
| | | 1,2,4-Trimethylbenzene | U | µg/L | |
| | | 1,2,3-Trimethylbenzene | U | µg/L | |
| | | 1,2,3,4-Tetramethylbenzene | 0.6 | µg/L | |
| OT45-R2 | 4-Aug-96 | Replicate | | | Water |
| | | Benzene | U | µg/L | |
| | | Ethyl Benzene | U | µg/L | |
| | | Toluene | U | µg/L | |
| | | Total Xylenes (m,p & o) | U | µg/L | |
| | | Chlorobenzene | U | µg/L | |
| | | 1,3,5-Trimethylbenzene | U | µg/L | |
| | | 1,2,4-Trimethylbenzene | U | µg/L | |
| | | 1,2,3-Trimethylbenzene | U | µg/L | |
| | | 1,2,3,4-Tetramethylbenzene | U | µg/L | |
| OT45-TB | 4-Aug-96 | Trip Blank | | | Water |
| | | Benzene | U | µg/L | |
| | | Ethyl Benzene | U | µg/L | |
| | | Toluene | U | µg/L | |
| | | Total Xylenes (m,p & o) | U | µg/L | |
| | | Chlorobenzene | U | µg/L | |
| | | 1,3,5-Trimethylbenzene | U | µg/L | |
| | | 1,2,4-Trimethylbenzene | U | µg/L | |
| | | 1,2,3-Trimethylbenzene | U | µg/L | |
| | | 1,2,3,4-Tetramethylbenzene | U | µg/L | |
| OT45-FB | 4-Aug-96 | Field Blank | | | Water |
| | | Benzene | U | µg/L | |
| | | Ethyl Benzene | U | µg/L | |
| | | Toluene | U | µg/L | |
| | | Total Xylenes (m,p & o) | U | µg/L | |
| | | Chlorobenzene | U | µg/L | |
| | | 1,3,5-Trimethylbenzene | U | µg/L | |
| | | 1,2,4-Trimethylbenzene | U | µg/L | |
| | | 1,2,3-Trimethylbenzene | U | µg/L | |
| | | 1,2,3,4-Tetramethylbenzene | U | µg/L | |
| OT45-W1 | 4-Aug-96 | Water Blank | | | Water |
| | | Benzene | U | µg/L | |
| | | Ethyl Benzene | U | µg/L | |
| | | Toluene | U | µg/L | |
| | | Total Xylenes (m,p & o) | U | µg/L | |
| | | Chlorobenzene | U | µg/L | |
| | | 1,3,5-Trimethylbenzene | U | µg/L | |
| | | 1,2,4-Trimethylbenzene | U | µg/L | |
| | | 1,2,3-Trimethylbenzene | U | µg/L | |
| | | 1,2,3,4-Tetramethylbenzene | U | µg/L | |

U = compound analyzed for, but not detected above reporting limits. Reporting limits are roughly the method detection limits for reagent water.

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

| | | | |
|----------------------|-----------|--------------------|------------------------|
| Client Sample Number | : MW-11 | Client Project No. | : 725520.500 Wurtsmith |
| Lab Sample Number | : X05424 | Lab Project No. | : 95-1136 |
| Date Sampled | : 4/6/95 | Dilution Factor | : 1.00 |
| Date Received | : 4/7/95 | Method | : 602 |
| Date Prepared | : 4/12/95 | Matrix | : Water |
| Date Analyzed | : 4/12/95 | Lab File No. | : BX2041210 |
| | | Method Blank No. | : MB041295 |

| Compound Name | Cas Number | Sample Concentration ug/L | RL ug/L |
|---|-----------------------------------|---------------------------------|----------------------|
| Benzene | 71-43-2 | 0.9 | 0.4 |
| Toluene | 108-88-3 | U | 0.4 |
| Chlorobenzene | 108-90-7 | U | 0.4 |
| Ethyl Benzene | 100-41-4 | U | 0.4 |
| Total Xylenes (m, p & o) | 108-38-3, 106-42-3 and 95-47-6 | U | 0.4 |
| 1,3,5-Trimethylbenzene | 108-67-8 | U | 0.4 |
| 1,2,4-Trimethylbenzene | 95-63-6 | U | 0.4 |
| 1,2,3-Trimethylbenzene | 526-73-8 | U | 0.4 |
| 1,2,3,4-Tetramethylbenzene | 488-23-3 | 4.7 | 0.4 |
| Surrogate Recovery (α,α,α -Trifluorotoluene): | | 91% | 70%-130% (QC limits) |

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:

E = Extrapolated value.

U = Compound analyzed for, but not detected.

B = Compound also found in the blank.

RL = Reporting Limit.

NA = Not Available/Not Applicable.


Analyst


Approved

1994 VALIDATION RESULTS

**MS/MSD SAMPLES &
GC/MS CONFIRMATION SAMPLES**

EVERGREEN ANALYTICAL, INC.
4036 Youngfield Wheat Ridge CO 80033
(303) 425-6021

GCMS CONFIRMATION

| | | | |
|-------------------------|------------|--------------------|---------------|
| Client Sample Number | : MW-11 | Client I.D. | : 725520.500/ |
| Lab Sample Number | : X05424 | | WURTSMITH |
| Date Sampled | : 04/06/95 | Lab Project No. | : 95-1136 |
| Date Received | : 04/07/95 | Effective Dilution | : 1.00 |
| Date Extracted/Prepared | : 04/10/95 | Method | : 8240(8260) |
| Date Analyzed | : 04/10/95 | Matrix | : WATER |
| Methanol Extract? | : N | Lab File No. | : >V6324 |
| Percent Loss on Drying | : NA | Method Blank No. | : RB041095 |

| Compound Name | Cas Number | Conc. ug/L | PQL* ug/L |
|-------------------------------------|------------|---------------|--------------|
| Benzene | 71-43-2 | U | 5 |
| Toluene | 108-88-3 | U | 5 |
| Ethyl Benzene | 100-41-4 | U | 5 |
| Total Xylenes | 1330-20-7 | U | 5 |
| Chlorobenzene | 108-90-7 | U | 5 |
| 1,2,4-Trimethylbenzene | 95-63-6 | U | 10 |
| 1,2,3-Trimethylbenzene | 526-73-8 | U | 10 |
| 1,3,5-Trimethylbenzene (Mesitylene) | 108-67-8 | U | 10 |
| 1,2,3,4-Tetramethylbenzene | 488-23-3 | 3 | 10 |
| Styrene | 100-42-5 | U | 5 |

| Surrogate Recoveries: | | QC Limits |
|-----------------------|------|-----------|
| 1,2 Dichloroethane-d4 | 101% | (83-112) |
| Toluene-d8 | 101% | (93-104) |
| Bromofluorobenzene | 103% | (87-105) |

Qualifiers:

U = Compound analyzed for, but not detected above the reporting limit(0.2 ppb)
R = Reporting limits are roughly the method detection limits in reagent water.
E = Indicates an estimated value when the compound is detected, but is below the Practical Quantitation Limit (PQL).
B = Compound found in blank and sample. Compare blank and sample data.
C = Compound is detected at a concentration outside the calibration limits.
P = Practical Quantitation Limits listed are approximately 10 times the detection limits for reagent water.
Unless otherwise noted all concentrations and PQL's for soils are quantitated on an as is basis.
NA = Not applicable or not available

Analyst

Approved

Evergreen Analytical, Inc.
4036 Youngfield, Wheat Ridge, CO 80033
(303) 425-6021

BTEX Water Matrix Spike/Matrix Spike Duplicate Data Report

| | | | |
|-------------------|--------------|--------------------|----------------|
| Client Sample No. | : W407-SS51S | Client Project No. | : 725524.03000 |
| Lab Sample No. | : X95774 | | Wurtsmith AFB |
| Date Sampled | : 10/3/94 | Lab Project No. | : 94-3825 |
| Date Received | : 10/6/94 | EPA Method No. | : 8020 |
| Date Prepared | : 10/17/94 | Matrix | : Water |
| Date Analyzed | : 10/18/94 | Lab File Number(s) | : BX2101723,24 |
| | | Method Blank | : MB101794 |

| Compound | Spike Added (ug/L) | Sample Concentration (ug/L) | MS Concentration (ug/L) | MS %REC | QC Limits %REC |
|---------------|--------------------|-----------------------------|-------------------------|---------|----------------|
| Benzene | 20 | 0 | 16.3 | 81.5 | 65-121 |
| Toluene | 20 | 0.8 | 15.1 | 71.5 | 69-117 |
| Ethyl Benzene | 20 | 0 | 14.6 | 73 | 68-118 |
| m/p-Xylene | 20 | 1.3 | 15.1 | 69 | 66-116 |
| o-Xylene | 20 | 0.5 | 15.1 | 73 | 73-117 |
| 1,3,5-TMB | 20 | 0 | 14.5 | 72.5 | 65-121 |
| 1,2,4-TMB | 20 | 0 | 14.9 | 74.5 | 65-121 |
| 1,2,3-TMB | 20 | 0 | 15.5 | 77.5 | 65-121 |

| Compound | Spike Added (ug/L) | MSD Concentration (ug/L) | MS %REC | RPD | QC Limits | |
|---------------|--------------------|--------------------------|---------|--------|-----------|--------|
| | | | | | RPD | %REC |
| Benzene | 20 | 19.4 | 97 | 17.4 | 17.4 | 65-121 |
| Toluene | 20 | 18.6 | 89 | 21.8 * | 15.8 | 69-117 |
| Ethyl Benzene | 20 | 18.2 | 91 | 22.0 * | 11.9 | 68-118 |
| m/p-Xylene | 20 | 19.1 | 89 | 25.3 * | 15.4 | 66-116 |
| o-Xylene | 20 | 18.4 | 89.5 | 20.3 * | 15.9 | 73-117 |
| 1,3,5-TMB | 20 | 17.9 | 89.5 | 21.0 * | 17.4 | 65-121 |
| 1,2,4-TMB | 20 | 17.9 | 89.5 | 18.3 * | 17.4 | 65-121 |
| 1,2,3-TMB | 20 | 19.1 | 95.5 | 20.8 * | 17.4 | 65-121 |

* = Values outside of QC limits.

RPD: 7 out of (8) outside limits.

Spike Recovery: 0 out of (16) outside limits.

Comments: CJC

MS surrogate recovery: 81%. MSD surrogate recovery: 97%.

SOIL SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: EVERGREEN ANALYTICAL INC.
 Lab Project No.: 94-3825
 Lab Sample No.: X95774
 Lab File Ids.: >26914,5

Client I.D.: 725524.03000-
 WURTSMITH AFB
 Client Sample No.: W407-SS51S
 Date Extracted: 10/13/94

| COMPOUND | SPIKE ADDED (mg/ml) | SAMPLE CONCENTRATION (mg/ml) | MS CONCENTRATION (mg/ml) | MS % REC # | QC LIMITS %REC |
|-------------------------|---------------------------|------------------------------------|--------------------------------|------------------|----------------------|
| Phenol | 200 | 0.00 | 166.99 | 83 | 26-90 |
| 2-Chlorophenol | 200 | 0.00 | 145.49 | 73 | 25-102 |
| 1,4-Dichlorobenzene | 100 | 0.00 | 70.17 | 70 | 28-104 |
| N-Nitrosodipropylamine | 100 | 0.00 | 89.58 | 90 | 41-126 |
| 1,2,4-Trichlorobenzene | 100 | 0.00 | 62.01 | 62 | 38-107 |
| 4-Chloro-3-methylphenol | 200 | 0.00 | 149.32 | 75 | 26-103 |
| Acenaphthene | 100 | 0.00 | 74.64 | 75 | 31-137 |
| 4-Nitrophenol | 200 | 0.00 | 175.70 | 88 | 11-114 |
| 2,4-Dinitrotoluene | 100 | 0.00 | 74.61 | 75 | 28-89 |
| Pentachlorophenol | 200 | 0.00 | 166.96 | 83 | 17-109 |
| Pyrene | 100 | 0.00 | 80.91 | 81 | 35-142 |

| COMPOUND | SPIKE ADDED (mg/ml) | MSD CONCENTRATION (mg/ml) | MSD % REC # | RPD # | QC LIMITS RPD | %REC |
|-------------------------|---------------------------|---------------------------------|-------------------|-------|---------------------|--------|
| Phenol | 200 | 179.46 | 90 | 7.2 | 35 | 26-90 |
| 2-Chlorophenol | 200 | 156.84 | 78 | 7.5 | 50 | 25-102 |
| 1,4-Dichlorobenzene | 100 | 76.62 | 77 | 8.8 | 27 | 28-104 |
| N-Nitrosodipropylamine | 100 | 96.76 | 97 | 7.7 | 38 | 41-126 |
| 1,2,4-Trichlorobenzene | 100 | 67.27 | 67 | 8.1 | 23 | 38-107 |
| 4-Chloro-3-methylphenol | 200 | 159.29 | 80 | 6.5 | 33 | 26-103 |
| Acenaphthene | 100 | 80.11 | 80 | 7.1 | 19 | 31-137 |
| 4-Nitrophenol | 200 | 155.41 | 78 | 12 | 50 | 11-114 |
| 2,4-Dinitrotoluene | 100 | 79.32 | 79 | 6.1 | 47 | 28-89 |
| Pentachlorophenol | 200 | 166.05 | 83 | 0.55 | 47 | 17-109 |
| Pyrene | 100 | 89.80 | 90 | 10 | 36 | 35-142 |

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

RPD: 0 out of 11 outside limits.

Spike Recovery: 0 out of 22 outside limits.

Comments: Values are reported in mg/ml in the liquid concentrate.

Evergreen Analytical, Inc.
4036 Youngfield, Wheat Ridge, CO 80033
(303) 425-6021

BTEX Water Matrix Spike/Matrix Spike Duplicate Data Report

| | | | |
|-------------------|-------------|--------------------|----------------|
| Client Sample No. | : MPA-OT45S | Client Project No. | : 725523.03000 |
| Lab Sample No. | : X95429 | Lab Project No. | : 94-3750 |
| Date Sampled | : 9/28/94 | EPA Method No. | : 8020 |
| Date Received | : 9/30/94 | Matrix | : Water |
| Date Prepared | : 10/9/94 | Lab File Number(s) | : BX2100921,22 |
| Date Analyzed | : 10/10/94 | Method Blank | : MB100994 |

| Compound | Spike Added (ug/L) | Sample Concentration (ug/L) | MS Concentration (ug/L) | MS %REC | QC Limits %REC |
|---------------|--------------------|-----------------------------|-------------------------|---------|----------------|
| Benzene | 20 | 0 | 17.1 | 85.5 | 65-121 |
| Toluene | 20 | 0.4 | 12.2 | 59* | 69-117 |
| Ethyl Benzene | 20 | 0 | 15.9 | 79.5 | 68-118 |
| m/p-Xylene | 20 | 0 | 15.3 | 76.5 | 66-116 |
| o-Xylene | 20 | 0 | 16 | 80 | 73-117 |
| 1,3,5-TMB | 20 | 0 | 15.7 | 78.5 | 65-121 |
| 1,2,4-TMB | 20 | 0 | 14.6 | 73 | 65-121 |
| 1,2,3-TMB | 20 | 0 | 15.7 | 78.5 | 65-121 |

| Compound | Spike Added (ug/L) | MSD Concentration (ug/L) | MSD %REC | RPD | QC Limits | |
|---------------|--------------------|--------------------------|----------|-----|-----------|--------|
| | | | | | RPD | %REC |
| Benzene | 20 | 16.9 | 84.5 | 1.2 | 17.4 | 65-121 |
| Toluene | 20 | 12.8 | 62* | 5.0 | 15.8 | 69-117 |
| Ethyl Benzene | 20 | 15.9 | 79.5 | 0.0 | 11.9 | 68-118 |
| m/p-Xylene | 20 | 15.2 | 76 | 0.7 | 15.4 | 66-116 |
| o-Xylene | 20 | 15.7 | 78.5 | 1.9 | 13.2 | 73-117 |
| 1,3,5-TMB | 20 | 15.1 | 75.5 | 3.9 | 17.4 | 65-121 |
| 1,2,4-TMB | 20 | 14.0 | 70 | 4.2 | 17.4 | 65-121 |
| 1,2,3-TMB | 20 | 14.8 | 74 | 5.9 | 17.4 | 65-121 |

*= Values outside of QC limits.

RPD: 0 out of (8) outside limits.

Spike Recovery: 2 out of (16) outside limits.

Comments: CJC

Evergreen Analytical, Inc.
4036 Youngfield, Wheat Ridge, CO 80033
(303) 425-6021

BTEX Water Matrix Spike/Matrix Spike Duplicate Data Report

Client Sample No. : MW-70T45W Client Project No. : 725523.03000
Lab Sample No. : X95433 Lab Project No. : 94-3750
Date Sampled : 9/28/94 EPA Method No. : 8020
Date Received : 9/30/94 Matrix : Water
Date Prepared : 10/1/94 Lab File Number(s) : BX1093026,27
Date Analyzed : 10/1/94 Method Blank : MB093094

| Compound | Spike Added (ug/L) | Sample Concentration (ug/L) | MS Concentration (ug/L) | MS %REC | QC Limits %REC |
|---------------|--------------------|-----------------------------|-------------------------|---------|----------------|
| Benzene | 20 | 1.7 | 15.2 | 67.5 | 65-121 |
| Toluene | 20 | 0.4 | 14.3 | 69.5 | 69-117 |
| Ethyl Benzene | 20 | 1 | 14.9 | 69.5 | 68-118 |
| m/p-Xylene | 20 | 0.6 | 14.6 | 70 | 66-116 |
| o-Xylene | 20 | 0 | 14.6 | 73 | 73-117 |

| Compound | Spike Added (ug/L) | MSD Concentration (ug/L) | MSD %REC | RPD | QC Limits | |
|---------------|--------------------|--------------------------|----------|--------|-----------|--------|
| | | | | | RPD | %REC |
| Benzene | 20 | 17.7 | 80 | 16.9 * | 17.4 | 65-121 |
| Toluene | 20 | 16.7 | 81.5 | 15.9 | 15.8 | 69-117 |
| Ethyl Benzene | 20 | 17.3 | 81.5 | 15.9 | 11.9 | 68-118 |
| m/p-Xylene | 20 | 16.7 | 80.5 | 14.0 * | 15.4 | 66-116 |
| o-Xylene | 20 | 16.6 | 83 | 12.8 * | 13.2 | 73-117 |

*= Values outside of QC limits.

RPD: 3 out of (5) outside limits.

Spike Recovery: 0 out of (10) outside limits.

Comments: CJC Surrogate recoveries: MS=67%, MSD=81%.
All Spike recoveries are acceptable. Poor purge cycle during analysis of MS caused poor surrogate and unacceptable RPD results. No rerun was performed.

SOIL SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: EVERGREEN ANALYTICAL INC.

Lab Project No.: 94-3750

Lab Sample No. : X95429

Lab File Ids. : >26787,26802

Client I.D. : 725523.03000

Client Sample No. : MPA-OT45S

Date Extracted : 10/04/94

| COMPOUND | SPIKE ADDED (mg/ml) | SAMPLE CONCENTRATION (mg/ml) | MS CONCENTRATION (mg/ml) | MS % REC # | QC LIMITS %REC |
|------------------------|---------------------------|------------------------------------|--------------------------------|------------------|----------------------|
| Naphthalene | 100 | 0.00 | 67.50 | 68 | NA |
| 1,4-Dichlorobenzene | 100 | 0.00 | 63.49 | 63 | 28-104 |
| N-Nitrosodipropylamine | 100 | 0.00 | 75.15 | 75 | 41-126 |
| 1,2,4-Trichlorobenzene | 100 | 0.00 | 58.09 | 58 | 38-107 |

| COMPOUND | SPIKE ADDED (mg/ml) | MSD CONCENTRATION (mg/ml) | MSD % REC # | RPD # | QC LIMITS RPD | %REC |
|------------------------|---------------------------|---------------------------------|-------------------|-------|---------------------|--------|
| Naphthalene | 100 | 74.16 | 74 | 9.4 | NA | NA |
| 1,4-Dichlorobenzene | 100 | 71.75 | 72 | 12 | 27 | 28-104 |
| N-Nitrosodipropylamine | 100 | 83.56 | 84 | 11 | 38 | 41-126 |
| 1,2,4-Trichlorobenzene | 100 | 65.23 | 65 | 12 | 23 | 38-107 |

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

RPD: 0 out of 4 outside limits.

Spike Recovery: 0 out of 8 outside limits.

Comments: Values are reported in mg/ml in the liquid concentrate.

WATER SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: EVERGREEN ANALYTICAL INC.

Lab Project No.: 94-3750

Lab Sample No. : X95433

Lab File Ids. : >26779,80

Client I.D. : 725523.03000

Client Sample No. : MW7-OT45S

Date Extracted : 09/30/94

| COMPOUND | SPIKE ADDED (mg/ml) | SAMPLE CONCENTRATION (mg/ml) | MS CONCENTRATION (mg/ml) | MS % REC # | QC LIMITS %REC |
|------------------------|---------------------------|------------------------------------|--------------------------------|------------------|----------------------|
| Naphthalene | 100 | 64.42 | 140.85 | 76 | NA |
| 1,4-Dichlorobenzene | 100 | 0.00 | 82.39 | 82 | 36-97 |
| N-Nitrosodipropylamine | 100 | 0.00 | 100.13 | 100 | 41-116 |
| 1,2,4-Trichlorobenzene | 100 | 0.00 | 76.17 | 76 | 39-98 |

| COMPOUND | SPIKE ADDED (mg/ml) | MSD CONCENTRATION (mg/ml) | MSD % REC # | RPD # | QC LIMITS RPD | %REC |
|------------------------|---------------------------|---------------------------------|-------------------|-------|---------------------|--------|
| Naphthalene | 100 | 147.74 | 83 | 8.6 | NA | NA |
| 1,4-Dichlorobenzene | 100 | 87.46 | 87 | 6 | 28 | 36-97 |
| N-Nitrosodipropylamine | 100 | 102.98 | 103 | 2.8 | 38 | 41-116 |
| 1,2,4-Trichlorobenzene | 100 | 79.81 | 80 | 4.7 | 28 | 39-98 |

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

RPD: 0 out of 4 outside limits.

Spike Recovery: 0 out of 8 outside limits.

Comments: Values are reported in mg/ml in the liquid concentrate.

Evergreen Analytical, Inc.
4036 Youngfield, Wheat Ridge, CO 80033
(303) 425-6021

BTEX Water Matrix Spike/Matrix Spike Duplicate Data Report

| | | | |
|-------------------|-------------|--------------------|----------------|
| Client Sample No. | : MW9-OT45W | Client Project No. | : 725524.03000 |
| Lab Sample No. | : X96712 | Lab Project No. | : 94-3984 |
| Date Sampled | : 10/12/94 | EPA Method No. | : 602 |
| Date Received | : 10/15/94 | Matrix | : Water |
| Date Prepared | : 10/22/94 | Lab File Number(s) | : BX2102219,20 |
| Date Analyzed | : 10/23/94 | Method Blank | : MB102294 |

| Compound | Spike Added (ug/L) | Sample Concentration (ug/L) | MS Concentration (ug/L) | MS %REC | QC Limits %REC |
|---------------|--------------------|-----------------------------|-------------------------|---------|----------------|
| Benzene | 20 | 0 | 19.8 | 99 | 65-121 |
| Toluene | 20 | 0 | 21.1 | 105.5 | 69-117 |
| Ethyl Benzene | 20 | 0 | 20.2 | 101 | 68-118 |
| m/p-Xylene | 20 | 0 | 20.6 | 103 | 66-116 |
| o-Xylene | 20 | 0 | 19.4 | 97 | 73-117 |
| Chlorobenzene | 20 | 0 | 19.3 | 96.5 | 65-121 |
| 1,3,5-TMB | 20 | 0 | 19.3 | 96.5 | 65-121 |
| 1,2,4-TMB | 20 | 0 | 18.8 | 94 | 65-121 |
| 1,2,3-TMB | 20 | 0 | 23.1 | 115.5 | 65-121 |

| Compound | Spike Added (ug/L) | MSD Concentration (ug/L) | MS %REC | RPD | QC Limits | |
|---------------|--------------------|--------------------------|---------|------|-----------|--------|
| | | | | | RPD | %REC |
| Benzene | 20 | 17.5 | 87.5 | 12.3 | 17.4 | 65-121 |
| Toluene | 20 | 19 | 95 | 10.5 | 15.8 | 69-117 |
| Ethyl Benzene | 20 | 18 | 90 | 11.5 | 11.9 | 68-118 |
| m/p-Xylene | 20 | 18.5 | 92.5 | 10.7 | 15.4 | 66-116 |
| o-Xylene | 20 | 17.5 | 87.5 | 10.3 | 13.2 | 73-117 |
| Chlorobenzene | 20 | 17.4 | 87 | 10.4 | 17.4 | 65-121 |
| 1,3,5-TMB | 20 | 17.7 | 88.5 | 8.6 | 17.4 | 65-121 |
| 1,2,4-TMB | 20 | 17.1 | 85.5 | 9.5 | 17.4 | 65-121 |
| 1,2,3-TMB | 20 | 20.5 | 102.5 | 11.9 | 17.4 | 65-121 |

* = Values outside of QC limits.

RPD: 0 out of (9) outside limits.

Spike Recovery: 0 out of (18) outside limits.

Comments: CJC

WATER SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: EVERGREEN ANALYTICAL INC.
 Lab Project No.: 94-3984
 Lab Sample No. : X96709
 Lab File Ids. : >26978,9

Client I.D. : 725524.03000-
 WURTSMITH AFB
 Client Sample No. : MW1-OT45W
 Date Extracted : 10/19/94

| COMPOUND | SPIKE ADDED (mg/ml) | SAMPLE CONCENTRATION (mg/ml) | MS CONCENTRATION (mg/ml) | MS % REC # | QC LIMITS %REC |
|------------------------|---------------------------|------------------------------------|--------------------------------|------------------|----------------------|
| Naphthalene | 100 | 0.00 | 93.02 | 93 | NA |
| 1,4-Dichlorobenzene | 100 | 0.00 | 72.97 | 73 | 36-97 |
| N-Nitrosodipropylamine | 100 | 0.00 | 110.71 | 111 | 41-116 |
| 1,2,4-Trichlorobenzene | 100 | 0.00 | 61.74 | 62 | 39-98 |
| Acenaphthene | 100 | 0.00 | 81.66 | 82 | 46-118 |
| 2,4-Dinitrotoluene | 100 | 0.00 | 80.11 | 80 | 24-96 |
| Pyrene | 100 | 0.00 | 90.97 | 91 | 26-127 |

| COMPOUND | SPIKE ADDED (mg/ml) | MSD CONCENTRATION (mg/ml) | MSD % REC # | RPD # | QC LIMITS RPD | %REC |
|------------------------|---------------------------|---------------------------------|-------------------|-------|---------------------|--------|
| Naphthalene | 100 | 82.46 | 82 | 12 | NA | NA |
| 1,4-Dichlorobenzene | 100 | 62.33 | 62 | 16 | 28 | 36-97 |
| N-Nitrosodipropylamine | 100 | 101.12 | 101 | 9.1 | 38 | 41-116 |
| 1,2,4-Trichlorobenzene | 100 | 53.07 | 53 | 15 | 28 | 39-98 |
| Acenaphthene | 100 | 71.84 | 72 | 13 | 31 | 46-118 |
| 2,4-Dinitrotoluene | 100 | 72.23 | 72 | 10 | 38 | 24-96 |
| Pyrene | 100 | 76.70 | 77 | 17 | 31 | 26-127 |

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

RPD: 0 out of 7 outside limits.

Spike Recovery: 0 out of 14 outside limits.

Comments: Values are reported in mg/ml in the liquid concentrate.

WATER SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: EVERGREEN ANALYTICAL INC.
 Lab Project No.: 94-3930
 Lab Sample No. : X96364
 Lab File Ids. : >26953,4

Client I.D. : 725523.03000-
 WURTSMITH AFB
 Client Sample No. : MW5-OT45W
 Date Extracted : 10/13/94

| COMPOUND | SPIKE ADDED (mg/ml) | SAMPLE CONCENTRATION (mg/ml) | MS CONCENTRATION (mg/ml) | MS % REC # | QC LIMITS %REC |
|------------------------|---------------------------|------------------------------------|--------------------------------|------------------|----------------------|
| Naphthalene | 100 | 31.98 | 112.90 | 81 | NA |
| 1,4-Dichlorobenzene | 100 | 0.00 | 80.28 | 80 | 36-97 |
| N-Nitrosodipropylamine | 100 | 0.00 | 105.28 | 105 | 41-116 |
| 1,2,4-Trichlorobenzene | 100 | 0.00 | 69.51 | 70 | 39-98 |
| Acenaphthene | 100 | 1.24 | 87.10 | 86 | 46-118 |
| 2,4-Dinitrotoluene | 100 | 0.00 | 66.52 | 67 | 24-96 |
| Pyrene | 100 | 0.00 | 87.83 | 88 | 26-127 |

| COMPOUND | SPIKE ADDED (mg/ml) | MSD CONCENTRATION (mg/ml) | MSD % REC # | RPD # | QC LIMITS RPD | %REC |
|------------------------|---------------------------|---------------------------------|-------------------|-------|---------------------|--------|
| Naphthalene | 100 | 108.91 | 77 | 5.1 | NA | NA |
| 1,4-Dichlorobenzene | 100 | 79.77 | 80 | 0.64 | 28 | 36-97 |
| N-Nitrosodipropylamine | 100 | 103.75 | 104 | 1.5 | 38 | 41-116 |
| 1,2,4-Trichlorobenzene | 100 | 67.88 | 68 | 2.4 | 28 | 39-98 |
| Acenaphthene | 100 | 83.75 | 84 | 2.5 | 31 | 46-118 |
| 2,4-Dinitrotoluene | 100 | 62.03 | 62 | 7 | 38 | 24-96 |
| Pyrene | 100 | 87.38 | 86 | 1.9 | 31 | 26-127 |

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

RPD: 0 out of 7 outside limits.

Spike Recovery: 0 out of 14 outside limits.

Comments: Values are reported in mg/ml in the liquid concentrate.

Evergreen Analytical, Inc.
4036 Youngfield, Wheat Ridge, CO 80033
(303) 425-6021

BTEX Water Matrix Spike/Matrix Spike Duplicate Data Report

| | | | |
|-------------------|-------------|--------------------|----------------|
| Client Sample No. | : MW4-OT45S | Client Project No. | : 725523.03000 |
| Lab Sample No. | : X95488 | Lab Project No. | : 94-3764 |
| Date Sampled | : 9/29/94 | EPA Method No. | : 8020 |
| Date Received | : 10/1/94 | Matrix | : Soil |
| Date Prepared | : 10/10/94 | Lab File Number(s) | : BX2101020 |
| Date Analyzed | : 10/11/94 | Method Blank | : MB101094 |

| Compound | Spike Added (ug/L) | Sample Concentration (ug/L) | MS Concentration (ug/L) | MS %REC | QC Limits %REC |
|---------------|--------------------|-----------------------------|-------------------------|---------|----------------|
| Benzene | 20 | 0 | 12.7 | 63.5* | 65-121 |
| Toluene | 20 | 0 | 12.1 | 60.5* | 69-117 |
| Ethyl Benzene | 20 | 0 | 10.4 | 52* | 68-118 |
| m/p-Xylene | 20 | 0 | 9.4 | 47* | 66-116 |
| o-Xylene | 20 | 0 | 10.6 | 53* | 73-117 |
| 1,3,5-TMB | 20 | 0 | 8.8 | 44* | 65-121 |
| 1,2,4-TMB | 20 | 0 | 8.7 | 43.5* | 65-121 |
| 1,2,3-TMB | 20 | 0 | 10.6 | 53* | 65-121 |

| Compound | Spike Added (ug/L) | MSD Concentration (ug/L) | MSD %REC | RPD | QC Limits | |
|---------------|--------------------|--------------------------|----------|-----|-----------|--------|
| | | | | | RPD | %REC |
| Benzene | 20 | NA | NA | NA | 17.4 | 65-121 |
| Toluene | 20 | NA | NA | NA | 15.8 | 69-117 |
| Ethyl Benzene | 20 | NA | NA | NA | 11.9 | 68-118 |
| m/p-Xylene | 20 | NA | NA | NA | 15.4 | 66-116 |
| o-Xylene | 20 | NA | NA | NA | 13.2 | 73-117 |
| 1,3,5-TMB | 20 | NA | NA | NA | 17.4 | 65-121 |
| 1,2,4-TMB | 20 | NA | NA | NA | 17.4 | 65-121 |
| 1,2,3-TMB | 20 | NA | NA | NA | 17.4 | 65-121 |

* = Values outside of QC limits.

RPD: NA out of (8) outside limits.

Spike Recovery: 8 out of (16) outside limits.

Comments: CJC
MS surrogate recovery: 58%. MSD did not purge on this run.
MS & MSD analyzed 10/17/94.

Evergreen Analytical, Inc.
4036 Youngfield, Wheat Ridge, CO 80033
(303) 425-6021

BTEX Water Matrix Spike/Matrix Spike Duplicate Data Report

| | | | |
|-------------------|-------------|--------------------|----------------|
| Client Sample No. | : MW4-OT45S | Client Project No. | : 725523.03000 |
| Lab Sample No. | : X95488 | Lab Project No. | : 94-3764 |
| Date Sampled | : 9/29/94 | EPA Method No. | : 8020 |
| Date Received | : 10/1/94 | Matrix | : Soil |
| Date Prepared | : 10/16/94 | Lab File Number(s) | : BX2101620 |
| Date Analyzed | : 10/17/94 | Method Blank | : MB101694 |

| Compound | Spike Added (ug/L) | Sample Concentration (ug/L) | MS Concentration (ug/L) | MS %REC | QC Limits %REC |
|---------------|--------------------|-----------------------------|-------------------------|---------|----------------|
| Benzene | 20 | 0 | 15.4 | 77 | 65-121 |
| Toluene | 20 | 0 | 15.2 | 76 | 69-117 |
| Ethyl Benzene | 20 | 0 | 13.4 | 67* | 68-118 |
| m/p-Xylene | 20 | 0 | 14.2 | 71 | 66-116 |
| o-Xylene | 20 | 0 | 12.3 | 61.5* | 73-117 |
| 1,3,5-TMB | 20 | 0 | 11.9 | 59.5* | 65-121 |
| 1,2,4-TMB | 20 | 0 | 9.8 | 49* | 65-121 |
| 1,2,3-TMB | 20 | 0 | 7.6 | 38* | 65-121 |

| Compound | Spike Added (ug/L) | MSD Concentration (ug/L) | MSD %REC | RPD | QC Limits | |
|---------------|--------------------|--------------------------|----------|-----|-----------|--------|
| | | | | | RPD | %REC |
| Benzene | 20 | NA | NA | NA | 17.4 | 65-121 |
| Toluene | 20 | NA | NA | NA | 15.8 | 69-117 |
| Ethyl Benzene | 20 | NA | NA | NA | 11.9 | 68-118 |
| m/p-Xylene | 20 | NA | NA | NA | 15.4 | 66-116 |
| o-Xylene | 20 | NA | NA | NA | 13.2 | 73-117 |
| 1,3,5-TMB | 20 | NA | NA | NA | 17.4 | 65-121 |
| 1,2,4-TMB | 20 | NA | NA | NA | 17.4 | 65-121 |
| 1,2,3-TMB | 20 | NA | NA | NA | 17.4 | 65-121 |

* = Values outside of QC limits.

RPD: NA out of (8) outside limits.

Spike Recovery: 5 out of (16) outside limits.

Comments: CJC
MS surrogate recovery: 78%. MSD did not purge on this run.

WATER SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: EVERGREEN ANALYTICAL INC.

Lab Project No.: 94-3764

Lab Sample No. : X95490

Lab File Ids. : >26784,85

Client I.D. : 725523.03000

Client Sample No. : MW8-OT45W

Date Extracted : 10/01/94

| COMPOUND | SPIKE ADDED (mg/ml) | SAMPLE CONCENTRATION (mg/ml) | MS CONCENTRATION (mg/ml) | MS % REC # | QC LIMITS %REC |
|------------------------|---------------------------|------------------------------------|--------------------------------|------------------|----------------------|
| Naphthalene | 100 | 0.00 | 84.12 | 84 | NA |
| 1,4-Dichlorobenzene | 100 | 0.00 | 71.25 | 71 | 36-97 |
| N-Nitrosodipropylamine | 100 | 0.00 | 98.89 | 99 | 41-116 |
| 1,2,4-Trichlorobenzene | 100 | 0.00 | 65.67 | 66 | 39-98 |

| COMPOUND | SPIKE ADDED (mg/ml) | MSD CONCENTRATION (mg/ml) | MSD % REC # | RPD # | QC LIMITS RPD | %REC |
|------------------------|---------------------------|---------------------------------|-------------------|-------|---------------------|--------|
| Naphthalene | 100 | 88.82 | 89 | 5.4 | NA | NA |
| 1,4-Dichlorobenzene | 100 | 73.61 | 74 | 3.3 | 28 | 36-97 |
| N-Nitrosodipropylamine | 100 | 102.25 | 102 | 3.3 | 38 | 41-116 |
| 1,2,4-Trichlorobenzene | 100 | 68.00 | 68 | 3.5 | 28 | 39-98 |

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

RPD: 0 out of 4 outside limits.

Spike Recovery: 0 out of 8 outside limits.

Comments: Values are reported in mg/ml in the liquid concentrate.

WATER SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: EVERGREEN ANALYTICAL INC.
 Lab Project No.: 94-3846
 Lab Sample No.: X95861
 Lab File Ids.: >26892,93

Client I.D.: 725524.03
 Client Sample No.: MW10-OT45W
 Date Extracted: 10/07/94

| COMPOUND | SPIKE ADDED (mg/ml) | SAMPLE CONCENTRATION (mg/ml) | MS CONCENTRATION (mg/ml) | MS % REC # | QC LIMITS %REC |
|-------------------------|---------------------------|------------------------------------|--------------------------------|------------------|----------------------|
| Phenol | 200 | 0.00 | 217.01 | 109 * | 12-89 |
| 2-Chlorophenol | 200 | 0.00 | 200.59 | 100 | 27-123 |
| 1,4-Dichlorobenzene | 100 | 0.00 | 94.71 | 95 | 36-97 |
| N-Nitrosodipropylamine | 100 | 0.00 | 125.77 | 126 * | 41-116 |
| 1,2,4-Trichlorobenzene | 100 | 0.00 | 81.89 | 82 | 39-98 |
| 4-Chloro-3-methylphenol | 200 | 0.00 | 197.60 | 99 * | 23-97 |
| Acenaphthene | 100 | 0.00 | 99.28 | 99 | 46-118 |
| 4-Nitrophenol | 200 | 0.00 | 224.50 | 112 * | 10-80 |
| 2,4-Dinitrotoluene | 100 | 0.00 | 100.19 | 100 * | 24-96 |
| Pentachlorophenol | 200 | 0.00 | 241.67 | 121 * | 9-103 |
| Pyrene | 100 | 0.00 | 78.97 | 79 | 26-127 |
| NAPHTHALENE | 100 | 0.00 | 106.14 | 106 | NA |

| COMPOUND | SPIKE ADDED (mg/ml) | MSD CONCENTRATION (mg/ml) | MSD % REC # | RPD # | QC LIMITS RPD | %REC |
|-------------------------|---------------------------|---------------------------------|-------------------|-------|---------------------|--------|
| Phenol | 200 | 209.56 | 105 * | 3.5 | 42 | 12-89 |
| 2-Chlorophenol | 200 | 183.58 | 92 | 8.9 | 40 | 27-123 |
| 1,4-Dichlorobenzene | 100 | 95.23 | 95 | 0.55 | 28 | 36-97 |
| N-Nitrosodipropylamine | 100 | 122.73 | 123 * | 2.4 | 38 | 41-116 |
| 1,2,4-Trichlorobenzene | 100 | 81.22 | 81 | 0.82 | 28 | 39-98 |
| 4-Chloro-3-methylphenol | 200 | 194.80 | 97 * | 1.4 | 42 | 23-97 |
| Acenaphthene | 100 | 97.34 | 97 | 2 | 31 | 46-118 |
| 4-Nitrophenol | 200 | 80.64 | 40 | 94 * | 50 | 10-80 |
| 2,4-Dinitrotoluene | 100 | 94.95 | 95 | 5.4 | 38 | 24-96 |
| Pentachlorophenol | 200 | 111.75 | 56 | 74 * | 50 | 9-103 |
| Pyrene | 100 | 79.58 | 80 | 0.77 | 31 | 26-127 |
| NAPHTHALENE | 100 | 100.75 | 101 | 5.2 | NA | NA |

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

RPD: 2 out of 11 outside limits.

Spike Recovery: 9 out of 22 outside limits.

Comments: Values are reported in mg/ml in the liquid concentrate.

Evergreen Analytical, Inc.
4036 Youngfield, Wheat Ridge, CO 80033
(303) 425-6021

BTEx Water Matrix Spike/Matrix Spike Duplicate Data Report

| | | | |
|-------------------|---------------|--------------------|----------------|
| Client Sample No. | : W408-SS51 S | Client Project No. | : 725524.03000 |
| Lab Sample No. | : X96963 | Wurtsmith AFB | |
| Date Sampled | : 10/3/94 | Lab Project No. | : 94-3869 |
| Date Received | : 10/8/94 | EPA Method No. | : 8020 |
| Date Prepared | : 10/19/94 | Matrix | : Water |
| Date Analyzed | : 10/20/94 | Lab File Number(s) | : BX2101918,19 |
| | | Method Blank | : MB101994 |

| Compound | Spike Added (ug/L) | Sample Concentration (ug/L) | MS Concentration (ug/L) | MS %REC | QC Limits %REC |
|---------------|-----------------------|--------------------------------|----------------------------|---------|-------------------|
| Benzene | 20 | 0 | 18.4 | 92 | 65-121 |
| Toluene | 20 | 0 | 17.3 | 86.5 | 69-117 |
| Ethyl Benzene | 20 | 0 | 16.9 | 84.5 | 68-118 |
| m/p-Xylene | 20 | 0 | 16.1 | 80.5 | 66-116 |
| o-Xylene | 20 | 0 | 16.7 | 83.5 | 73-117 |
| 1,3,5-TMB | 20 | 0 | 18.2 | 91 | 65-121 |
| 1,2,4-TMB | 20 | 0 | 16.5 | 82.5 | 65-121 |
| 1,2,3-TMB | 20 | 0 | 19.6 | 98 | 65-121 |

| Compound | Spike Added (ug/L) | MSD Concentration (ug/L) | MS %REC | RPD | QC Limits | |
|---------------|-----------------------|-----------------------------|---------|-----|-----------|--------|
| | | | | | RPD | %REC |
| Benzene | 20 | 17.8 | 89 | 3.3 | 17.4 | 65-121 |
| Toluene | 20 | 16.3 | 81.5 | 6.0 | 15.8 | 69-117 |
| Ethyl Benzene | 20 | 16.5 | 82.5 | 2.4 | 11.9 | 68-118 |
| m/p-Xylene | 20 | 15.2 | 76 | 5.8 | 15.4 | 66-116 |
| o-Xylene | 20 | 16.1 | 80.5 | 3.7 | 13.2 | 73-117 |
| 1,3,5-TMB | 20 | 16.9 | 84.5 | 7.4 | 17.4 | 65-121 |
| 1,2,4-TMB | 20 | 15.7 | 78.5 | 5.0 | 17.4 | 65-121 |
| 1,2,3-TMB | 20 | 18.7 | 93.5 | 4.7 | 17.4 | 65-121 |

* = Values outside of QC limits.

RPD: 0 out of (8) outside limits.

Spike Recovery: 0 out of (16) outside limits.

Comments: CJC

WATER SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: EVERGREEN ANALYTICAL INC.

Lab Project No.: 94-3869

Lab Sample No. : X95962

Lab File Ids. : >26850,1

Client I.D. : 725524.03

Client Sample No. : W409M-SS51W

Date Extracted : 10/10/94

| COMPOUND | SPIKE ADDED (mg/ml) | SAMPLE CONCENTRATION (mg/ml) | MS CONCENTRATION (mg/ml) | MS % REC # | QC LIMITS %REC |
|------------------------|---------------------------|------------------------------------|--------------------------------|------------------|----------------------|
| Naphthalene | 100 | 0.00 | 89.95 | 90 | NA |
| 1,4-Dichlorobenzene | 100 | 0.00 | 71.59 | 72 | 36-97 |
| N-Nitrosodipropylamine | 100 | 0.00 | 97.66 | 98 | 41-116 |
| 1,2,4-Trichlorobenzene | 100 | 0.00 | 60.94 | 61 | 39-98 |

| COMPOUND | SPIKE ADDED (mg/ml) | MSD CONCENTRATION (mg/ml) | MSD % REC # | RPD # | QC LIMITS RPD | %REC |
|------------------------|---------------------------|---------------------------------|-------------------|-------|---------------------|--------|
| Naphthalene | 100 | 93.64 | 94 | 4 | NA | NA |
| 1,4-Dichlorobenzene | 100 | 69.70 | 70 | 2.7 | 28 | 36-97 |
| N-Nitrosodipropylamine | 100 | 103.02 | 103 | 5.3 | 38 | 41-116 |
| 1,2,4-Trichlorobenzene | 100 | 65.40 | 65 | 7.1 | 28 | 39-98 |

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

RPD: 0 out of 4 outside limits.Spike Recovery: 0 out of 8 outside limits.

Comments: Values are reported in mg/ml in the liquid concentrate.

1992 RI ANALYTICAL RESULTS

TABLE 4-11

SUMMARY OF SOIL ANALYSIS
SITE 01-45
DRAFT RI DELIVERY ORDER 10
WORTSMITH AIR FORCE BASE

Sample #: S80T45143 S80T45052 S80T45055 S80T45056 S80T45059
Sample Location: H42-OT45 S81-OT45 S82-OT45 S82-OT45 S83-OT45
Sample Depth (Ft.): 9 - 11 11.5 - 13.5 10 - 12 10 - 12 (D) 10 - 12
Sampling Date: 11/09/92 10/23/92 10/23/92 10/23/92 10/23/92

| Parameter | Type A ¹ | Type B ² | Units | | |
|-----------------|---------------------|---------------------|-------|----------|-------------------------|
| Ethylbenzene | 10 | 8E+06 | µg/kg | 42.00 | 2800.00 1900.00 4100.00 |
| Fluoranthene | 330 | 1E+07 | µg/kg | 12000.00 | |
| Fluorene | 330 | 1E+07 | µg/kg | 220.00 | 5100.00 |
| Naphthalene | 330 | 1E+07 | µg/kg | 1600.00 | 15000.00 |
| Phenanthrene | 330 | ID | µg/kg | 500.00 | 11000.00 |
| Toluene | 10 | 2E+07 | µg/kg | 260.00 | 210.00 |
| Xylenes (total) | 30 | 2E+08 | µg/kg | 2600.00 | 6000.00 |

D Duplicate

ID Insufficient Data

- (1) Michigan Act 307 levels - Background/Method Detection Limits
(2) Michigan Act 307 Direct Contact Levels

TABLE 4-12

SUMMARY OF GROUNDWATER ANALYSIS
 SITE OT-45
 DRAFT RI DELIVERY ORDER 10
 WRIGHTSMITH AIR FORCE BASE

Sample #: GWOT45135 GWOT45136 GWOT45140 GWOT45142 GWOT45W015
 Sample Location: HW2-OT45 HW2-OT45 HW2-OT45 HW2-OT45 V-OT45
 Sample Depth (Ft.): 9 - 12 19 - 22 52 - 55 58 - 61 13.4
 Sampling Date: 11/09/92 11/09/92 11/09/92 11/09/92 10/23/92

| Parameter | Type A ¹ | Type B ² | Unit | Value |
|-----------------|---------------------|---------------------|------|-------|
| Benzene | 1 | | µg/L | 26.00 |
| Ethylbenzene | 1 | 700 | µg/L | 1.00 |
| Fluorene | 5 | 6000 | µg/L | 7.60 |
| Naphthalene | 5 | 600 | µg/L | 7.00 |
| Phenanthrene | 5 | 330 | µg/L | 18.00 |
| Toluene | 1 | 1000 | µg/L | 12.00 |
| Xylenes (total) | 3 | 10,000 | µg/L | 3.20 |
| | | | | 51.00 |

(1) Michigan Act 307 Levels - Background/Method Detection Limits

(2) Michigan Act 307 Direct Contact Levels